THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 54 Thursday, February 13, 1936 No. 1017

PUBLISHED WEEKLY

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF

The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

Institute of British Foundrymen

PRESIDENT: 1935-36

J. E. Hurst, "Ashleigh," Trent Valley Road, Lichfield, Staffs.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.
Birmingham, Coventry and West Midlands: A. A. Timmins, A.I.C., 21-23, St. Paul's Square, Birmingham.
Sheffield: T. R. Walker, "The Priory," Oughtibridge, near Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.
London: H. W. Lockwood, Stewarts and Lloyds, Limited, Winchester House, Old Broad Street, London, E.C.2.
Newcastle-upon-Tyne: W. Scott, Sir W. G. Armstrong, Whitworth & Company (Ironfounders), Limited, Close Works, Gateshead-on-Tyne.
East Midlands: B. Gale, "Parkdale," Boulton Lane, Alvaston, Derby.
West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.
Wales and Monmouth: J. J. McClelland, 122, Wellington Road, Bilston, Staffs.
Middlesbrough: D. Anderson, 147, Stockton Street, Middlesbrough.
Preston: P. Leyland, 6, Ashley Terrace, Farington, Lancs.
Lincoln: E. R. Walter, M.Sc., The Technical College, Lincoln.
Burnley: W. Haworth, 37, Westbourne Avenue, Burnley, Lancs.
Falkirk: R. McNair, "Braewick," Larbert Road, Bonnybridge, Scotland.

National Ironfounding Employers' Association

President: J. Smith, Smith & Company (South Shields), Limited, Nile Street, South Shields.
Secretary: Harold G. Judd, C.B.E., 8, Frederick's Place, E.C.2.

The Institute of Vitreous Enamellers

President: Dr. J. W. Mellor, F.R.S., Sandon House, Regent Street, Stoke-on-Trent.
Chairman: W. H. Whittle, W. H. Whittle, Limited, Eccles, near Manchester.
Hon. Secretary: Miss E. Christine Elliot, 49, Wellington Street, Strand, London, W.C.2.

Foundry Trades' Equipment and Supplies Association

President: G. T. Lunt, "Briardene," Newbridge Avenue, Wolverhampton.
Secretary: E. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association

President: W. E. Clement, Morfa Foundry, New Dock, Llanelly.
Secretary: J. D. D. Davis, 9, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION

The Registered Office and Laboratories of the B.C.I.R.A. are:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM
Telephone: Central 1885. *Telegrams: CIRA*
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk
Telephone: 332

Contents

	PAGE
Mechanised Production	133
A Hardy Annual	133
Castings and Electrodeposition	134
Correspondence	136
Foundry Students Visit Core-Oil Factories	136
Meehanite Research Institute	136
Manchester and District Ironfounders Employers' Association	136
Catalogues Received	136
Machine Moulding	137
Metal Moulds for Cast Iron	140
Light Alloys	140
Steel Agreement with South Africa	140
The Control of Cupola Operation	141
American Notes and Developments	142
Frit-Kiln Bricks	143
I.B.F.—Lancashire Branch Annual Dinner	144
Leaves from a Foundryman's Notebook	146
German Pig-iron Trade in 1935	146
This Week's News in Brief	148
Contracts Open	148
Company Reports	148
Application for Trade Marks	148
Personal	148
Obituary	148
Forthcoming Events	148
Raw Material Markets	150
West of Scotland Iron and Steel Institute	150

Mechanised Production

A very great change has come over the foundry industry during the past few years in the direction of mechanised production and continuous production. Some large establishments have led the way and have production resources and systems as fine in their way as anything the engineering industry proper can show. Foundry engineering has emerged as an almost separate profession, and the development has given valuable stimulus to the designers and makers of foundry equipment. The office of plant engineer in such concerns is an exacting and onerous one, for breakdown of plant may seriously upset a carefully-arranged production schedule. Foundries are becoming places in which no youth could be ashamed to work, for they are now being made light, airy, well heated and well ventilated, and this is bound to react on the future supply of suitable men for the industry. In so far as the present conditions are causing something like a shortage of really skilled labour, they are bound to promote the tendency to mechanised production, and the capital is more likely to be available in an industry which is working profitably. The increase in demand goes in the same direction, and altogether the tendency will increase rather than diminish in future.

Many foundries, however, have still to realise the possibilities of working on a semi-mechanised basis. The ordinary jobbing shop does not hesitate as a rule to put work on to machines when the demand justifies it, but often without due regard to the planning which would get the best out of the arrangement. For many medium-size foundries it is not essential to have elaborate conveying systems or sand-handling systems in order to realise the benefits of centralised sand treatment and machine production. With such an outlook on the part of progressive proprietors, much of the complaint against price-cutting by the back-street founder would cease to exist, and friendly arrangements would promote specialisation and production economy without any reduction in volume of work. All the conditions would then exist in this country for the development of an active, well-staffed foundry equipment industry, which would make the country independent of foreign designs. Naturally, sound ideas embodied in novel equipment may occur and be developed in any country, and it is right and proper that they should be adopted here. But the soundness of British design and the robustness of British engineering practice makes our own plant preferable if it can be obtained, and is also likely to be welcomed by British founders overseas.

A Hardy Annual

From time to time we hear of claims for new processes which will "revolutionise" existing practice in the heavy industries. Most of these see the light through a sensational and ill-informed Press, which at one and the same time seems to sound the death knell to the "revolution." Scientific achievement in our heavy industries has not reached finality—far from it—but in the light of past experience each new revolutionary announcement is, naturally enough, received by technicians with an increasing amount of scepticism. And so "The Far Eastern Review," quoting "The Tokio Nichi-Nichi," directs attention to the achievements of Hideyuki Kikuchi, a young Japanese graduate, who claims to have discovered and patented a process "to revolutionise the steel industry." The process, it is stated, has been patented in 15 countries at a cost of 15,000 yen, although the Japanese patent authorities are said to have had difficulty in grasping the fundamentals. Greatest interest seems to centre around the fact that Dr. Honda has been favourably impressed.

As far as can be gathered, the method consists of an "electric beam wave" for smelting, which "dissolves" ores mixed with fuel in from 30 to 60 sec. The invention has, of course, "outdistanced present-day applied science by 100 years," and after it has been "put on a practical basis" Bessemer and other furnaces will no longer be necessary. Moreover, "high-grade steel can be made at a ridiculously low cost," and it will no longer be necessary for Japan to import annually 200 million yen worth of iron and steel. As usual with these processes, "such metals as iridium, tungsten, aluminium (or aluminum) and chromium can be produced at a much lower cost than at present." The most gratifying aspect of the announcement seems to be that "both the Nippon Seitetsu Kaisha at Yawata and the South Manchurian Railway oil-shale works at Fushun, upon hearing of the invention, reconsidered their intention of ordering larger furnaces from Germany."

Castings and Electrodeposition

The Paper on "Troubles Experienced in Electrodeposition due to Unsuitable Castings,"* read by MR. B. CAPLAN at a joint meeting of the Institute of British Foundrymen and the Electrodepositors' Technical Society, in Birmingham recently, provoked an extremely interesting discussion, which was opened by the CHAIRMAN (Mr. L. Wright), who called on Mr. G. M. Callaghan (President of the Birmingham Branch of the Institute of British Foundrymen) to propose a vote of thanks to Mr. Caplan for his lecture. MR. CALLAGHAN expressed appreciation of the steps taken by the Electrodepositors' Technical Society to secure a joint meeting of that kind. They would, he said, be better able to solve these problems by getting together and obtaining the benefit of each other's experience. Similarly, he thought that the ground of the lecturer's remarks about consecutive consignments of castings becoming poorer in quality could be put right if foundrymen were in closer touch with the shops dealing with castings after they had left the foundry. He himself had been able to satisfy engineers much better when he had obtained permission to walk round their shops, and to see castings in the lathe and note the defects which faced engineers in the use of these castings. In the description of nickel and chromium plating they, as foundrymen, had been very much interested, and they were glad to hear Mr. Caplan put his viewpoint on castings. Of course, the complaint that users of castings were let down by the foundry was quite an old one, which foundrymen did not always accept on their face value. MR. H. BACHE (Electrodepositors' Technical Society) seconded the vote in endorsing the compliments passed by the mover, and it was carried unanimously.

Gun-Metal Presents Difficulties

The CHAIRMAN opened the discussion by stating that, although he happened to be interested in electrodeposition, he could not attain the equivalent of what the lecturer mentioned for scrap—one-tenth of 1 per cent. Nor could he imagine any production shop being run at anything like that figure. Irrespective of whether castings were good or bad, the plater could make a poor job of them, and on this point he noticed that the lecturer mentioned that sometimes jobs had to be rushed, and that the question of efficient degreasing then entered into the matter of a properly-finished order. If the foundryman was required to tighten up his inspection, then the plater should also do so, and ensure that the individual processes of plating should be carried through with the maximum degree of efficiency. He believed that joint discussions of that nature would help to make plating easier, because the airing of problems which required solution would tend to co-ordinate design and finish. Mr. Wright cited the modern water tap as an example. The difficulties which the plater used to experience with the old type of tap brought about a change in design which made it easy to plate and clean, and very often the article was easier to cast also. Aluminium castings for plating purposes would probably interest some of them, and possibly someone present might throw some light on this aspect. Regarding blowholes, every defect of this character presented a difficulty in plating irrespective of the type of metal employed; and, whether they used brass, gunmetal, iron or aluminium, there were peculiar difficulties belonging to the metal itself. Personally, he had found that gunmetal was more difficult to plate than brass or copper, because it was essentially greasy and more difficult to etch. Incidentally, he observed that Mr. Caplan had laid stress on the importance of getting sand out of castings, and seeing that cleaning was so vital to a sound job, perhaps Mr. Jesson could give them some information. At the same time, he thought that the lecturer would have referred more particularly to hydrofluoric acid in the pickling of ferrous castings.

MR. W. F. JESSON (Electrodepositors' Technical Society) remarked that it would be interesting to know to what extent the grease was occluded in iron castings. He came across a case recently where it was being worked with great advantage on bronze castings. However, the firm concerned found great difficulty in removing the grease out of these castings when worn down for remodelling purposes, and it was essential to machine the surface. Whether the lecturer had tried trichlorethylene for this work he did not know, but he should expect boiling liquid trichlorethylene to get out all the grease. As to the time required, he should not anticipate that it would exceed three minutes, because the vapour of the trichlorethylene would not then be sufficient, as the article would heat up at a temperature at which decomposition would cease before it discharged all the grease that was deeply occluded. This applied both to iron castings or to non-ferrous. He should be glad to hear of cases where trichlorethylene had been used and whether unsuccessful or not, because such information would be a help in solving some of their difficulties. He himself did not know of any drawback to the use of trichlorethylene on castings, but, of course, any castings thoroughly degreased would be liable to rust on exposure in a damp atmosphere, if they did not, then they were not properly degreased.

Castings Normally Good

MR. G. M. CALLAGHAN, observing that the lecturer had referred to the majority of castings as of poor quality through lack of homogeneity and bad surface, suggested that he was exaggerating. Mr. Caplan admitted that they occasionally obtained good castings, and that sometimes these castings passed pressure and examination tests; and he would suggest that as the lecturer's firm undoubtedly conducted its business on sound lines, what had been said was put strongly in order to emphasise the importance of suitable supplies. Certainly examples had been placed before them which were not good, but if they took them in detail he thought they could ignore the first, which was one of a large quantity containing sand, because such castings should be sand-blasted. He had made hundreds of tons of castings for chromium plating, and he did not think he had ever seen anything like the example shown. He once had a curious experience in making castings for some part of a car radiator. They were sand-blasted, and looked well when delivered. At the motor works they were dipped in some acid and in a tin solution. Normally the castings supplied to that firm were tinned after this process, but they had not been sand-blasted. He had to explain why the castings—it was a first batch—sent by his firm did not retain the tinning; and it was only after some investigation that he discovered that the previous supply was not sand-blasted, and then tinned by the process he had seen. After that they did no more sand-blasting on this particular order; but he thought that one of Mr. Caplan's difficulties could be eliminated if his castings were sand-blasted. If platers had difficulties in regard to lead, zinc, brass or iron owing to their differing composition, then it would be advisable to consult with the foundryman so that he could co-operate with the object of eliminating them. There ought to be no great difficulty in the use of any metal and the proper melting of it, and in keeping down the lead, zinc and iron to the required limits. He considered that porosity was his greatest difficulty in respect to taps. This was owing to the wide variations in thickness, ranging from $\frac{3}{8}$ths of an inch to $\frac{1}{16}$th, and to the raised seat. Some firms, of course, did not have this seat. In his own case they were endeavouring to overcome it by arranging an adequate runner for the thick part. By co-operating with the foundrymen he believed that many of the lecturer's difficulties would be overcome, and there would not be, as seemed to be suggested, any need for consecutive consignments of castings to become worse, nor for any plating firm to change from foundry to foundry, because if that were done one was likely to have to start at the beginning again to obtain suitable castings.

MR. SCHOFIELD (E.T.S.) referred to difficulties of electrodeposition in connection with porosity and degreasing. He cited an instance where castings were plated, but stripped. They were done again, and after some four or five immersions, and after a thorough heating and then a thorough cooling, the work turned out successfully.

Aluminium Die Castings Preferred

MR. B. J. R. EVANS (E.T.S.) said he himself did not recollect having experienced any serious difficulty, although occasionally they received porous castings, and he should say that the rejects on this account were about comparable to rejects from other causes. Cast iron did not appear to have been specifically mentioned, and possibly someone present might have encountered difficulty when plating that material. His experience with cast iron was that the castings had been sound and very little trouble encountered. His firm had handled a small quantity of aluminium for chromium plating, and here they had encountered rather more difficulty owing to porosity. There did appear to be an inherent difficulty in the case of aluminium, apparently due to surface porosity, and he much preferred to use die castings. However, he gathered that the trouble with aluminium castings was being overcome by improved technique. Regarding the lack of contact between plater and foundryman, one had to bear in mind that very often a third party entered into the question who required to have castings plated. Thus the plater was not always in a position that his supply department provided the castings, in which case they might not be so satisfactory for the job. Obviously there were two main ways whereby their products might be improved: through foundry development, and through plating shop observation; and by getting together the representatives of these sections they could no doubt solve many of their present troubles. If they could secure the co-operation of those responsible for designing jobs, then this joining together should be still more helpful.

Structure of Cast-Iron and Plating Problems

MR. A. A. TIMMINS (Hon. Secretary, Midland Section, I.B.F.) asked whether Mr. Caplan had noticed any variation in the nickel plating of cast iron of different types, possessing defects other than such obvious ones as blow-holes and sand inclusions. The speaker proceeded to show two types of cast iron on the screen, similar in composition but of different structures, which had been produced by special treatment by the British Cast Iron Research Association with a view to changing grain size and graphite size. They would notice in one section that there were large graphite flakes, and alongside these they found plating difficult and not easy to secure proper adhesion. Pointing to another section of the sample, Mr. Timmins drew attention to the plating not being continuous, due he thought in part to the large graphite flakes and the large grain size of the casting; and also to the fact that the finish which could be applied to such a casting would be inferior to that which could be obtained with a finer-grained casting. The third slide showed the treated iron possessing fine grain and graphite size. In this case

* See FOUNDRY TRADE JOURNAL, January 23, pp. 83-84.

the plating was continuous and of good adherence. Both castings were plates 3 in. in dia. and received exactly the same treatment, the work being carried out by a firm accustomed to nickel-plate jobs on cast iron. Mr. Callaghan had, he observed, made a suggestion that if electrodepositors got together and talked these matters over with the foundrymen, they would be able to arrive at a better understanding, and the latter would more likely be able to supply castings which would plate successfully. It seemed that not only had the composition of the iron to be correct, observed Mr. Timmins, but also that the structure must be in a suitable state for electroplating to be successful; and from these few experiments it appeared that grain size and graphite size in cast iron were of some importance in securing this end. It was on this account that he had inquired if the lecturer had experienced any difficulty in plating cast-iron parts which did not show such obvious defects as sand inclusions in the surface and blow-holes, and whether in plating he had found faults due to any differences in the grain and graphite size of castings.

MR. BACHE thought that the whole question "boiled down" to one of cost, and agreed with Mr. Hurren on this point. Taking the case of the outdoor plater, here he was required to do a good deal of *light-class* work on castings which were sometimes of the worst possible kind, and the work was wanted at a price at which it was almost impossible to produce it at a profit. He thought the safest way was for customers to pay more for good castings and for plating which was sound, but, unfortunately, many people would not pay for a good-class article, and that was the difficulty.

More Basic Information Needed

MR. LANGLEY (I.B.F.) suggested that the remedy lay largely with the platers, who did not know exactly what they required. For example, in the cast-iron section it appeared that some of them had only just found out that cast iron existed in several different forms. Large graphite flakes in cast iron were needed in some cases; for other purposes they were not. Apparently for plating purposes it was not needed, but the platers did not specify these points, nor that they required small-graphite irons. The plater should tell the foundry what he really wanted.

Hydrogen Occlusion

MR. J. G. S. PRIMROSE said that plating depended to a large extent on the base material. He had in mind a bath of chromium plating for cast iron of a rather unusual character, containing both nickel and chromium, and the cast iron seemed to have taken up a somewhat resentful attitude towards the deposition of chromium upon it. Hence special care had to be taken in preparing first of all the face, and then obtaining the proper base to go on to that in order to carry the chromium plating. Failure occurred earlier still where an alloy base had been put on. He recollected the lecturer referring to poor metal and poor plating; and, where alloy was plated, he wondered, had he noticed instances of a very much improved adherence of chromium plating and an improvement of its resistance to corrosion? The great difficulty seemed to be the enormous amount of hydrogen occlusion in the alloy. The solution not only throws the deposit, but liberates a greater volume of hydrogen, which, being nascent, was able to penetrate and remain occluded in the base metal to a large extent, with detrimental results to the adhesion of it. Referring to a zinc-base metal die cast on which chromium plating had to be produced, Mr. Primrose stated that die castings naturally were liable to porosity; and unless good venting allowed the escape of the heated gas, it might remain and form blow-holes, and although under the surface of polished material, it still had an effect on current density on particular areas below which blow-holes occur. In this way they did not obtain uniform current density which they wanted for plating; and where this was insufficient there was lack of conductivity, and consequent lack of throwing power in that area.

Chromium-Plated Brass Sheet

MR. LESTER alluded to chromium-plated brass strip which gradually developed a rusty deposit. It came on the hubs of motor-car wheels, which were dried after washing. The rust colour was removable by metal polish, but returned after a while at the same spot. He had been under the impression that chromium plating was rustproof and foolproof, but here it was not so.

He was interested in malleable castings; they had a lot of material which was required for plating, chiefly chromium, and their difficulty was that they did not know what the castings were for when their customers ordered them. They were simply told to make castings to a certain pattern. But only if customers would initially send a plated sample of what they wanted to produce, and were prepared to pay an advance on what they would consider a normal price, provided a certain standard was maintained, they would be certain to gain in the end. If their customers obtained a high percentage of good results, it would be better to let the supplier do the throwing out, which the latter could afford to do at the increased price given in the first instance. However, castings might be quite good, but not suitable for good plating.

MR. EVANS recalled seeing the development of crystalline effects over blow-holes on a job which could very well fall into the category of a large flat surface which required to be machined all over—the flywheel and starting ring of an outboard motor cased in gun-metal. This job caused considerable difficulty, and the trouble was met ultimately on the design end, inasmuch as there was a large flat surface immediately above the pulley groove. It was a piece of work which was almost as bad for casting and plating as one could get. They experienced an effect similar to that mentioned by Mr. Primrose, and he thought the trouble was due to the occlusion of acids in the pores of the casting which was actually plated over, with the result that there was chemical action taking place underneath the plating, and before complete polishing on the plating surface there were peculiar effects on this surface.

If some of the castings shown were brought into his firm's shop they would look a different job compared to those handed round. His firm was in a position to give an adequate amount of polishing to a job before plating. But he should add that jobs in their works were not cut down to a price irrespective of quality. As to the suggestion of one speaker about more suitable castings at an increased charge by the foundry, and its effect on costs in the plating department, it was a matter which might be gone into and verified. Most of these troubles could be tackled in the light of sheer economics, and whichever of the three sections—the design, the foundry and the plater—ultimately solved the problem through economic need, some increase in cost by those tackling the job was almost bound to be incurred, and where the extra cost went there must lie the onus of correcting the job.

Another member, speaking on behalf of the jobbing plater, suggested that foundries should ask their customers when an order was placed if the castings were for polishing and plating. If so, it might mean 10 to 20 per cent. more waste, but it would help the platers a good deal.

The CHAIRMAN, referring to Mr. Primrose's comments on hydrogen occlusions, said he thought they would find that a good deal of it was deposited, particularly in the case of chromium plating. Mr. Timmins had mentioned two important aspects, and he might say that the question of the composition of metal and its structure had formed the subject of a number of Papers which had appeared in their own journal, and in German and American technical publications. The plater was very much aware that the face of the metal had a very profound effect on the factor of deposition. Electro plating itself was only in its infancy, and had only changed from an art to a science in post-war years.

MR. HURREN stressed that the main point in producing better work all round was more co-operation, by the aid of which both departments could obtain a better return for their labour. There was too much looseness in placing orders for just a brass casting, a number of decent malleable iron castings, and a quantity of grey-iron castings, for nothing whatever was said as to the future treatment which those particular articles were to undergo. The only points which were emphasised, generally speaking, were that the castings must not have excessive machining in parts and limited grinding of certain parts. If they had to produce a fairly expensive casting, which was to be subject to after treatment which was somewhat costly in regard to polishing and plating, he thought they should be entitled to ask for a better price, and they would be justified in doing so, than the lowest price per cwt. which the buyer could exact. He believed that they would appreciate each other's difficulties more as a result of that discussion, and recognise that the life of a plater and polisher was not an easy one, while from experience he could assure them that the same applied to the work of a foundryman.

Author's Reply

MR. CAPLAN, replying to the discussion, thanked the foundrymen for the sporting manner in which they had taken his somewhat caustic remarks. His own firm stipulated what they required casting for, and always mentioned that they were for plating purposes, and they were quoted accordingly. They received really good samples, and the first batches were also good. They never changed their foundry suppliers either. He should certainly pass the samples put forward by Mr. Hurren. He recognised that they were bound to pick on "a few little holes," because after all they did not expect perfection. Mr. Caplan here mentioned an instance of their difficulties. A quantity of water fittings with blow-holes had to be tinned first before plating, and all the blow-holes had to be soldered over. Some of the castings he had referred to came from Birmingham. He could assure Mr. Callaghan that all the castings which stood pressure tests had to be tinned, and some were brazed, and this method was the only way in which they could make a sound job. These jobs were all heavily tinned, and sometimes after tinning the work had to be covered with solder. Most of the castings which they received were sand blasted, but sometimes this was not done through an oversight. He was not exaggerating when he said that the stripping was less than $\frac{1}{10}$ per cent. It amounted to practically nothing; the plating shop was expected to work on this ratio, and if there was any substantial extra amount the management wanted to know the reason why. His firm were manufacturers who supplied other manufacturers, and they could not at the prices paid afford to have faulty work. As an example, Mr. Caplan quoted an order for over two hundred pairs of taps, and of this lot only one was stripped—this was near the porcelain top which had a slight crack. He attributed this negligible amount of strip or faulty work to the fact that they worked on a standard routine based on experience, and it was rigidly adhered to. There was no wastage in the use of material, in saying which the lecturer described the different uses to which acids and material were put after the main operations. As to hydrofluoric acid, he did not like the liquid seeing that it got through the floor so easily, and really required a special floor laid down to resist it—although they did actually use some. He found that bronze metals were rather more difficult to handle, and wanted controlling much more than brass and other metals. On the question

of alternate degreasing, they used this method, cold and hot, when necessary. With regard to Mr. Jesson's remarks, he thought that what was really required was a degreasing fluid, which in addition to degreasing metals, was also in itself, self cleaning. They did a considerable amount of plating on cast-iron work, and, strange to say, they rarely, if ever, experienced any trouble with it. Among the goods done under this head were big counter rails for shopkeepers. At first they were left with some strips, but finally found out that this was due to hydrochloric fumes in the shop. In most plating shops, he thought, there was a little congestion at times. What they did was to get the acid as near as possible to the operation, but by the time they had got the casting to the nickel bath there was a slight film of oxide on the bars which caused a little trouble, so they moved the hydrochloric tank away under an exhaust fan and had never experienced any further difficulty. He did not think the grain size of cast iron had affected their work adversely, although he had noticed castings with a coarser grain than at other times. Costs entered into production and more or less controlled whether an order was given or obtained, and he agreed with one of the speakers that they must educate people to some extent, and impress upon them that they could not get something for nothing or more than they paid for. Mr. Langley and others had suggested advising the foundry of what was required and for what purpose, but he was afraid he must reply that in many cases foundrymen obtaining the orders were "Yes Men." He admired their optimism when they said good castings would be delivered, but he appreciated their troubles, and after hearing what Mr. Hurren had said, he thought sympathy should be on his side.

Continuing, Mr. Caplan said that in all plating—nickel, copper and so on—the question of cost arose. Still, although prices were often cut fine, most of the work done was good. He based this last remark largely on the work which came back to them, and he might mention that all of it was dated and certified. For example, consignments of fire extinguishers which had been nickel plated only had come back after being in service since 1927, and he was surpised to see the good condition of the nickel, although the pumps had failed owing to vibration on the lorries. Apart from cuts, the nickel was sound. He thought that chromium on nickel plating was to-day quite good, and he did not consider that alloy plating gave any advantage, taking results on the whole. Speaking of motor-car bumpers failing, the lecturer humorously remarked that he agreed with what a big motor manufacturer once said when he deprecated the use of rustless bumpers, because he did not want them to last for ever. People had complained that the metal had developed rust, although it was said to be chromium plated and rustless and stain proof. No doubt they had been told that much by motor salesmen. Incidentally, he might observe that, if they examined cars which were a few years old, although the engine was perhaps worn out and the body falling to pieces, the plating of metal parts remained as good as ever. One speaker had inquired about metal spray, with the suggestion that it was quite good, but he himself preferred plating, although he did not controvert that it would be very suitable for outside work and in maintaining the life of bridges and structural jobs. Regarding die castings, his view was that they were not suitable for his own type of business. They used sulphuric acid and other chemicals, and the gases which were liberated would be detrimental to zinc alloys. It was necessary in all cases to use metals that could withstand the action of acids and also of coal gas. As to the crystalline effect on chromium, he thought that there must have been something wrong with the plater's bath of chromium, perhaps chloride being present in the bath. Reverting to brown- or rust-coloured spots developing on motor-car hubs and head lamps, or on street-door knockers, he thought Mr. Wright would agree that, if they were chromium plated on a nickel undercoat, then all the after-treatment required was to keep the metal clean. Marks did occur in foggy weather, but these were easily cleaned off with a soft damp rag; on no account should metal polish be used on chrome work. These brown spots might be due to exhaust gases in the garage, and changes of temperature would also "spot" chrome, although this factor would not destroy it, provided they wiped the metal as soon as the spots appeared. The malleable-iron "Lever" samples were usually exceptionally good excepting for this delivery, but the other samples were as shown and not at all exaggerated. It was all very well to suggest that costs should be studied with a view to getting a fair price for improved quality. Everybody wanted an improved price, but generally they could not obtain it, and hence they had to make the best they could of the job. However, there were ways and means of getting down to the job, and he suggested that foundrymen could get down to it a little bit more and so help the plating side.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Blast Furnaces in the Black Country

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—With reference to the article on page 97 of your issue of January 30, we are afraid your contributor is under some misapprehension with regard to the number of blast-furnace plants still in existence in the Black Country, as there are at least nine, and, apart from the basic pig-iron plant referred to, there are four other plants to-day producing special and cold-blast pig-irons, chiefly from locally-mined ironstones for which South Staffordshire, Shropshire and Worcestershire have long been famous.—Yours, etc.,

ARTHUR J. WHILE,
Governing Director.

Hatherton Furnaces,
Bloxwich, Staffs.

February 4, 1936.

Foundry Students Visit Core-Oil Factories

Students from the British Foundry School visited the works of the Fordath Engineering Company, Limited, at West Bromwich, on February 5, under the guidance of the principal, Mr. J. Bamford, B.Sc. The research laboratory and machine shop were visited in turn. In the laboratory, methods for testing core sand and cores, and raw materials were explained in detail, and in the machine shop the construction of rotary core machines and "Rotoil" sand mixers was carefully explained. Afterwards different types of both machines were seen in actual operation, under foundry conditions.

Light refreshments were taken, and in the course of a short speech by the managing director, Major J. W. Athey, at the conclusion of the visit, it was pointed out that this was not only the first visit from the British Foundry School to the Fordath Works, but also the first visit, *en masse*, of any party to any works in the country, whose activities resembled those of the Fordath Company, and as such it was regarded as a unique occasion. Mr. Bamford, in his reply, remarked that he was surprised at the volume of general metallurgical work which was carried out in the laboratory, in addition to the research and routine work on core compounds, oil-sand mixtures, etc., and stated that the visit had been very instructive.

Meehanite Research Institute

Last Tuesday and Wednesday, the European licensees of the Meehanite process met together at the Charing Cross Hotel, London, to exchange views on the technical developments that have been made in the various foundries both in America and in Europe. Some 35 Papers were presented and discussed, and on the Tuesday evening an informal banquet was held, over which Mr. E. H. Jones presided. Mr. V. C. Faulkner was the principal guest, and addressed the company on the subject of improved organisation within the foundry industry and the advantages to be gained by close technical co-operation.

Mr. John Cameron, Past-President of the Institute of British Foundrymen, in thanking Mr. Faulkner for his address, emphasised that, although absent, Mr. Oliver Smalley was the moving spirit behind the Meehanite Research Institute, and he expressed the hope that on the occasion of their next meeting in June Mr. Smalley would be present.

Several of the foreign licensees also spoke, and expressed the great benefits that they had derived from attending these international meetings. The function closed with the passing of a vote of thanks to Mr. Jones for the arrangements that he had made for the holding of the meeting and the comfort of the members during their stay in London.

Manchester and District Ironfounders Employers' Association

The annual meeting of the Manchester and District Ironfounders' Employers' Association was held last Friday under the chairmanship of Mr. R. B. Wolfe at the Queens' Hotel, Manchester. The meeting was preceded by an informal dinner. Later in the evening the meeting was thrown open to the local ironfounders, and was addressed by Mr. V. C. Faulkner, Editor of THE FOUNDRY TRADE JOURNAL, on the subject of the organisation of the foundry industry at home and abroad. Mr. Faulkner briefly reviewed the conditions which existed in pre-War days, and then outlined some of the modern tendencies in trading conditions, and dealt with the organisation of the foundry industry in Belgium, Germany, France, Italy, Japan and America. An interesting discussion followed, and Mr. Faulkner was very cordially thanked for his address.

Catalogues Received

Automatic Regulators for Furnaces. A twenty-page brochure, received from the Cambridge Scientific Instrument Company, Limited, of 45, Grosvenor Place, London, S.W.1, is of especial interest as it carries a large number of illustrations of all types fitted with automatic temperature regulators for gas, oil, electrically-heated furnaces. The co-operation of most of the prominent furnace builders has been obtained and an excellent result has been achieved.

Dryers. The receipt of a twelve-page booklet from Head, Wrightson & Company, Limited, of Thornaby-on-Tees, dealing with the Ruggles-Coles and Lowden dryers, brought back a flood of memories to the reviewer, as at one time he was associated with a company handling the former type of dryer. This dryer consists of two concentric sheets installed in the horizontal position, but slightly inclined. Hot gases pass between the rotating sheets and also over the material to be dried. A thermal efficiency of 75 per cent is claimed.

The Lowden dryer is quite different, and is a hearth furnace carrying a rubbling mechanism

Machine Moulding*

By D. R. KINNELL

Before commencing this short Paper, the author would like to point out that, although dealing with machine moulding as stated, it is also intended to mention some of the various examples of light-type castings which can be made successfully on small machines. Most of the Papers given before the Institute are in connection with cast iron or steel, and it is usual to speak of heavy castings weighing up to 20 tons. None of the castings to be discussed will be in the region of even 40 lbs., but it is hoped that, by bringing these forward, there may be an interesting discussion of those interested in this matter from the light-casting point of view.

It is intended to view this matter in one phase rather than in general conditions with regard to machine moulding. Nowadays it is possible, owing to inventions with regard to the above coming forward at frequent intervals, for machine moulding in the general sense of the word to be carried out by hand or mechanical power. In the latter category, the machines can be worked by compressed air or electricity, but it is the former method, that of hand-moulding machines, that it is proposed to deal with in this Paper.

Unskilled Labour Possible

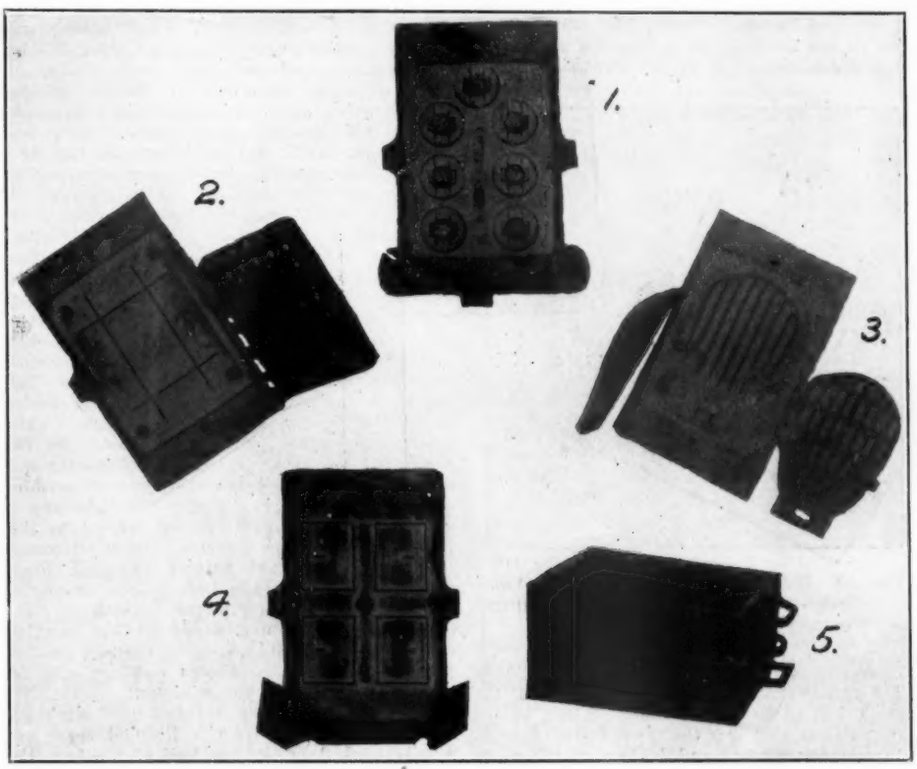
Power machines cost very much more, both for capital outlay, upkeep, plate patterns and boxes, than do the small type of hand-operated moulding machines. Of course, the larger and more expensive the machine, the larger the output, presumably, and the larger types of intricate castings can be tackled, but from the small or jobbing founder's point of view the machines to be described show in practice a good scope, providing every endeavour is made to get the most out of them. When looking into this matter from this angle, it will be appreciated that the use of these machines gives opportunity of employing unskilled youths who, with proper training, are soon able to produce a reasonable output. There is no cost for "power" and patterns and moulding-box costs may be kept to reasonable level.

This is a view which must be considered, as sometimes it is found that large quantities off are *not* required after the patterns have been made; consequently, in the case of the large and expensive machines, machine patterns, etc., the cost of making would be very large, and a loss might be shown. It is also necessary to turn to and compare the relative merits of "machine moulding" in a general sense, *i.e.*, from the hand-operated moulding-machine point of view to that of the loose-pattern method worked on the floor.

There are two chief items to note in this matter:—(1) Reduction in cost of manufacture by making on the machine; and (2) probable increase in output by this method. Dealing with the former, that of cost of manufacture—probably the most important—it can be stated that the cost of manufacture, taken from the moulding-cost point of view, would probably show appreciable reduction upon placing the casting for manufacture on the machine, it, of course, being understood that the other costs, such as labour, melting and dressing of castings, etc., remain constant whether the casting is moulded from a plate on the machine or from loose pattern on the floor.

It will, therefore, be found in some cases that the cost of the machine-plate pattern is not worth while, taking into consideration the possible small difference in the moulding cost. Also, the number of castings to be made is a point which must be given careful consideration, and will be referred to again later. Taking the second point, that of output, this is really the chief feature of plate-moulding machines, namely, facility of moulding at one time anything from, say, two to ten castings, depending on size, as against small loose patterns made one or perhaps two in a box on the floor.

Here again, of course, the quantity of castings required has to be taken into consideration, although in the case of a guaranteed delivery date, even though the quantity required may not justify the procedure, it may be necessary to place the casting on the machine irrespective of cost in order to obtain the requisite number in time stated. In either case it is necessary that each individual job be weighed up in all respects before any steps are taken to put it on the machine, as the costs of manufacture in these times must be given consideration.



FIGS. 1 TO 5.—TYPICAL MACHINE-PLATE PATTERNS AND BOX PARTS.

Fig. 1.—4-in. No. 5 valve discs. Fig. 2.—O.P. Bisson backplates. Fig. 3.—No. 3 H.S. boiler grates (old pattern). Fig. 4.—H.S. boiler new pattern doors. Fig. 5.—Two half-box parts.

More Accurate Castings

There is no doubt that machine-made castings are more accurate (*i.e.*, if plant is properly made) and of better finish, owing to the fact that they are worked off a true plate pattern, are of consistent weight due to the fact that the machine moulder is not able to *put on weight* as the loose pattern moulder likes to, in order to make the pouring of the casting safer. This does not happen when working off a machine-plate pattern. No undue rapping is necessary in the moulding, and providing sufficient taper has been allowed on the machine plate a clean draw is made every time.

Wastage of material such as sand, parting powder, etc., is cut down to a minimum as boxes and plate are made to suit each other and cut out any unnecessary work from the moulder's point of view. In fact, it may be stated that by placing the patterns on a plate and using a suitable hand-operated machine the moulder is relieved of an appreciable amount of work, and this should be advantageous both to the operator and management.

The Making of Machine-Plate Patterns

When it has been decided that certain types of castings can be suitably and profitably made on the machine, and this is in reference to machine moulding in general terms, then it is necessary to go about the preparation of machine-plate pattern. Generally the method of manufacturing plate patterns can be divided into two categories:—(1) When the pattern or patterns can be screwed on to the machine plate, and (2) those which are cast integral with the plate pattern.

Taking the former example, if one has a blank flange to make, it is obviously easier to machine up four blank flanges, *i.e.*, if four will go on to the plate, with only one contraction allowed on each of these patterns and then screw them on the machine plate, which has been faced or machined both sides—a 4-in. No. 5 valve-disc plate is an example of this and an illustration is shown in Fig. 1. This is the quickest method of placing patterns on the machine.

Preparing the Pattern

Taking the second method, *i.e.*, patterns integral with plate, there is shown in Fig. 2 an O.P. Bisson backplate—a more expensive type of plate pattern, although it will be noted that the casting to be made is not an intricate one. In this case the first stage is to prepare a wood pattern of the casting to be made allowing two contractions, one from wood to metal and one from metal pattern to plate pattern. It will be noted that the plate pattern (of back plate) incorporates core holes, and these being of simplest form are satisfactory in green sand.

* A Paper presented to the Middlesbrough Branch of the Institute of British Foundrymen, Mr. A. Scholes presiding.

Of course, in some cases when only one casting may be made on each plate only a wooden pattern need be made and this used immediately for manufacturing of the plate pattern. This, however, is not advisable, as will be shown. The plate pattern is more accurate when made from metal. In any case, when the plate pattern is made from wood pattern, it is advisable to make a metal one from the wooden pattern, when the pattern is either filed up or machined, or both as accurately as possible and given size of one contraction larger.

Having obtained the metal pattern, the machine plate pattern can be made. This calls for very careful moulding, as it is necessary for the pattern to be as accurate as possible. The complete metal pattern or patterns are sent to the moulder, together with a wooden frame which is of the overall external dimensions and thickness of the plate pattern required to be made. The frame is open in the centre and this is moulding into the box with pattern or patterns, in the usual way.

Great care must be taken in order that no slight slip or flaw is shown on the finished plate, as this would ruin it, or necessitate a great deal of labour being expended in the rectifying of the defect. Special attention should be paid to the sand in which these plates are made and also to the finishing of the moulds so that the plate finish may be as perfect as possible.

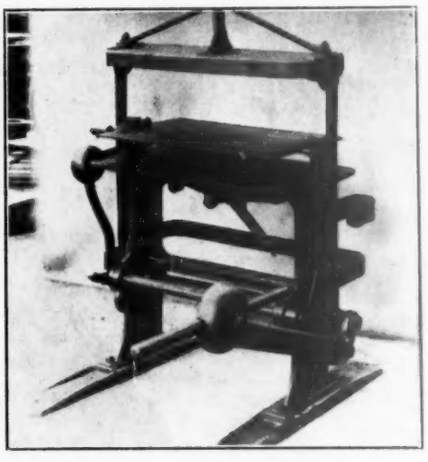


FIG. 6.—HAND-MOULDING MACHINE OF THE CRANK-WORKED TYPE, FOR DOUBLE-SIDED TURNOVER PATTERN PLATES.

In some cases, it will probably be found that owing to the shape of the casting, more of the pattern has to be put in the drag half of the plate pattern, that is if the type of casting tends to be uneven on top and bottom of the plate pattern. This, of course, tends to give uneven contraction on this plate when made, so steps must be taken to avoid this. Time and money spent on making patterns are repaid in the time saved when a pattern has to be filed or machined up—briefly, moulding plate patterns requires time and care.

The next requirement is to file the pattern to the required size, when the greatest possible accuracy must be attained to get the job perfectly easy to work and draw from the mould. This filing in the case of the intricate pattern is probably the most expensive item in the cost of plate patterns. The plate pattern is then ready for fitting to machine.

From the foregoing, it will no doubt be appreciated that the manufacture of the machine plate patterns is not an easy task. There are numerous possibilities to be looked into before the step of putting the casting on the machine is taken. The main item is accuracy, because if the pattern will not work easily in use, then it might as well be broken up. For one thing, the moulded castings will not be good from an indifferent pattern and the maximum output will not be obtained from the man working it, and in this case the job might more profitably be made on the floor off a loose pattern.

Examples of this are shown in Figs. 3 and 4, the former being a plate pattern for No. 3 H. S. boiler grates, old pattern, and the latter a plate for H. S. boiler new pattern doors, which shows up the coring. It is an uneven job, there being more of the pattern on one side of the plate than the other.

It is not proposed to go into details of foundry manufacture of plate patterns themselves, *i.e.*, from the moulding point of view as nearly every firm has its own idea of obtaining the cleanest and most accurate type of machine plate pattern.

Machine Boxes

The first point which arises is, of what material shall moulding boxes be made? As this Paper does not deal with the snap flask method of moulding, and seeing that the subject matter deals with machine moulding with reference to cast-iron castings, the opinion is that cast-iron boxes are the best, made from the metal manufactured on site. There are many advantages gained from having the raw material for the box parts on site, namely, when broken they can be remelted with the scrap, and new parts can quite easily be made.

As compared with this, if the use of steel be favoured, steel boxes are more expensive as an initial outlay, and although they may last longer, should any break or suffer any other material damage, they are expensive to replace and the price for the scrap is very small. As it is the small type of machine, which is to be discussed, for which plain boxes without bars are quite suitable for many of the types of castings, it should be understood that if rather intricate castings are to be made with special depths to draw from the mould, it is sometimes necessary to have special box bars cast or fitted in boxes in order that these castings will mould easily and safely. Two half box-parts are shown in Fig. 5 as examples, and it will be seen that these fit together quite easily. As a matter of fact, these two box parts are separately interchangeable with any other two box parts for this type of machine as they are drilled to a jig, in the same way as all machine plate patterns are drilled to this jig, so there will be universal fitting all round.

Both the top and bottom edges of these machine box parts have been planed, machined or surface-ground, completely smooth so that they will bed flat and firmly on the machine when rammed up and also make the best possible joint. This reduces wasted castings due to running out, etc., to the minimum.

The pins which are of steel are machined up to fit the holes from a jig and these are usually worked in the top half of the box, the moulder first of all fixing the top half of the box on the machine, holding it on with clamps and turning plate over then fitting the drag half, which is then rammed up. The machine is then turned over again so that the drag half is down and it will be seen that it is the drag half of the box which has to be drawn first, seeing that the pins are registered in the top half of the box through the plate. After this, the top half of the box can be drawn on the register without moving it at all, only of course, having turned over the plate pattern again.

The usual method of lifting these boxes is by casting in wrought-iron handles into the drag half, as shown in Fig. 5. Cast-iron lugs are sometimes used, but they protrude a long way from the box and often get broken off when the boxes are being knocked out after cast each day. There are the small lugs, of course, where the machine pins go through, but these are somewhat guarded by the handles from breakage, as is shown in Fig. 5. With these boxes fitting so neatly, the sand to be used is reduced to a minimum. This, of course, is essential, as no unnecessary work must be involved if the moulder is to get the maximum output of boxes per day.

Another point which requires attention is that sometimes, where heavier castings are being made, it is necessary to have a loose plate on the floor where the drag of the box is placed so that the castings do not sink in the mould when being run. The same applies to the top, when a heavy weight is placed on the top of the box to prevent swelling of the top part of the casting. This is in addition to the clamps which are used when heavier castings are being made, and these are all small detail extras which will be found applicable generally in a foundry, to all kinds of work.

Suitable Type of Moulding Machine

Whilst appreciating that there are numerous designs of suitable hand-moulding machines on the market, it is proposed to give particulars of one of which the writer has had some little experience. Fig. 6 illustrates this machine. It will be seen that the machine is a crank-worked one for a double-sided turnover pattern plate, of sufficient size to take plates to which reference has been previously made. The chief dimensions of this machine are as follow:—Maximum size of box which can be conveniently used, 18 in. by 18 in. (but this may vary, one dimension cut

FIG. 7.—THE MACHINE SHOWN IN FIG. 6 IN THE MAXIMUM RAISED POSITION.

down by lug and pin-holes, etc.); maximum size of plate which can be conveniently used, 24 in. by 18 in.; and maximum draw, 6 in. It will be seen, therefore, from the figures given that this machine has considerable scope.

From Fig. 6 it will be seen that there is simply an ordinary steel plate affixed to the swivels, and this is the manner in which these machines are usually supplied, in order to obviate breakages. It will also be seen that this machine has a squeezer arrangement on the top of the plate, so that, if necessary, when the box has been filled up with sand, this top squeezer part can be brought down by the crank handle on the right, to compress the sand without the use of any ramming tools.

This method is suitable for certain types of castings, but for more intricate types it has been found advisable to ram each box separately with ramming tools; consequently the crank and squeezer part can be dispensed with, and this makes the machine considerably lighter, in case of wishing to move it about, and also for the moulder to work. The larger crank on the left-hand side operates through levers and two spindles, and raises or lowers the pattern plate when affixed (not shown in the illustration), so that this turns over with the boxes attached to

it when ramming up either the drag or cope part of the box.

Fig. 7 shows the machine in the maximum raised position, whereby the pattern plates can be turned over with the box parts attached. Of course, it will be appreciated that in this instance no box parts are shown affixed to same. This machine is comparatively cheap to purchase, very light for internal transportation, and will stand up to the type of wear usually imposed on small hand-moulding machines. The design is simple, and consequently there is very little to go wrong and, if anything unforeseen occurs, replacements can be fitted quickly and are easily made. Owing to the easy manipulation, the machine is one that a youth can work, whereas some of the more complicated machines need a man to work them.

Fig. 8 shows the machine with the plate pattern mounted in the turnover position. This machine can be worked by boys of 16 years of age or more, who can quite comfortably get a good day's output with it. The output of the machine is regulated solely by the type of castings made. Of course, it is naturally assumed that the easy job would be carried out by a boy and the complicated work, incurring green-sand and dry cores, would be made by those more experienced.

Scope of the Machine

The scope of this machine depends largely on the size of boxes used. It must not be thought that only one size of box part has necessarily to be employed. However, the boxes usually used are the largest size possible in order to get castings made as economically as possible, by getting the most on each pattern plate. The output is also regulated by the type of casting made, namely, whether plain straightforward castings or cored ones and also the general intricacies of the plate pattern used. Of course, it is appreciated that the maximum output of castings is obtained on the plainest type of castings.

Wherever possible, green-sand cores should be used for this type of work, but, of course, it is understood that if the moulder is supplied with oil-sand cores the output is correspondingly greater than it is with green-sand cores. It is thought, however, that the use of green-sand cores gives a much better job from the point of view of finish of the castings, and the responsibility for turning out these jobs is then wholely dependent on the moulder, as he would make the core or cores himself. Also because the small oil-sand core castings are usually expensive to make, it will be found cheaper to give the moulder slight extra allowance for the job for making his own cores green sand whenever possible.

Fig. 9 shows a type of valve casting. It will be seen that the pattern plate is simply a double-sided one, with four castings on per box. The core box in which the cores are made green sand, is double, whereby four cores can be made at the same time. A less intricate type of casting requiring no coring is that of a gulley grate, pattern plate of which is shown in Fig. 10. This job, of course, is very simple and can be turned out in large quantities. As this plate is fairly thin, care must be taken in running the casting, and, naturally, the metal has to be poured as hot as practicable.

A third example is a type of water or expansion box. This is a more difficult casting and has to be made with an oil-sand core, owing to the fact that there is no method of supporting the core other than by that of chaplets in the mould, consequently green-sand core would not be suitable or applicable for this. The box used is very light-section metal and the same remarks with regard to facilities for pouring must be noted, namely, hot metal. In the case of this casting, of course, the moulder is supplied with the core, and care has to be taken that he does not increase the weight of these castings by running the core in order to get a slightly thicker-metal thickness on the wall of the casting to make the job safer, which is often the case in this type of casting. It will be appreciated that the castings coming out heavier than required is just so much waste of metal and consequent loss on each casting sold.

Organisation of Machine Foundries

With regard to the organisation of the machine-moulding shop, the first consideration is plenty of room. This refers to length, breadth, height of the building and room for machines, boxes, etc. Moreover a good organisation is necessary if the flow of work is to be uninterrupted, to ensure orders being executed in accordance with requirements. Proper plate-pattern racks are necessary for each moulder's place, so that these do not become broken. These racks, of course, are only temporary stores for the moulder to keep pattern plates for current orders—the main pattern stores to be arranged for at no great distance from the machine foundry, in order to keep the patterns which are not in use. In this respect it should be pointed out that while pattern plates are not in use they should be given a thin coat of oil in order to prevent rusting. It is necessary to strip this oil off the plate before sending same into the foundry, or else it will be found that a clean draw will not be obtained until the oil has worked off, and consequently a number of moulds will be lost. The same remarks apply with regard to fitting of core racks by the moulders' places for holding any green-sand cores which they may be required to make.

Although it is not, of course, usual to stove dry these green-sand cores, it will be found that the moulders, when they have a job calling for, say, six or eight boxes off, much prefer to mould, say, all the drag parts first, then make the cores to go in and finally the top parts, and this cannot be done unless there is sufficient core room for putting on these green-sand cores in the meantime. However, in some cases it will be found desirable to allow some of the cores to be air-dried overnight. This is found, of course, by experience. This method of work will be found much quicker than making each box and core in between. The core racks take rather intricate shapes in some cases owing to the fact that the cores and core bars of some castings are out of the ordinary.

If possible it should be arranged for some of the machines, *i.e.*, those with larger outputs, to travel on rails down the box line so that if the moulder has made thirty or more boxes, he has not to carry them further from the machine than necessary. This can quite easily be done with a little forethought and organisation. With further reference to remarks as to room or space, this of course plays a great part when casting time arrives each day.

It is essential that the rows of boxes be well divided so that the moulders can come through with ladle quite easily when necessary. This especially applies in the case of each box being cast individually by a moulder from small hand-ladle. In more advanced foundries, of course, it is probably found advisable to have a monorail fixed over the line of boxes with a larger hand-ladle suspended from it and operated by the moulder. In this way the moulder can probably cast a full row of boxes before bringing the ladle back to the source of supply. Again, after cast, when the time comes for emptying the boxes by labourers, plenty of room has to be available (if labourers do this; the same applies if moulders empty their own boxes).

The sand has to be knocked out of the boxes, and these are then stacked in pairs, properly mated, by the place where the moulder will begin to use his machine the next day. Castings have to be rapped out and then taken to the dressing shop for fettling. This dressing shop should be as near as possible, and it will, of course, be appreciated that in turning out castings from the boxes, a certain amount of care is necessary, to see there is the minimum of breakages, as most of these castings are light and fragile. It should also be stated that a machine moulding shop requires constant attention in order to obtain the best results, and it should be organised by some competent person who is able to spend some portion of his time in it daily.

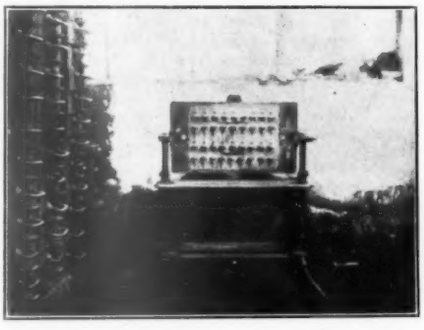


Fig. 8.—Hand-Moulding Machine with Plate Pattern in Turnover Position.

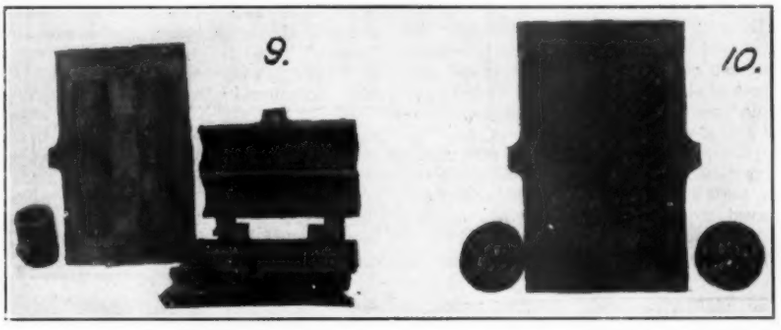


Fig. 9.—Plate for Valve Castings.

Fig. 10.—Plate for Gulley Grates.

Relative Costs

The usual impression is that with machine moulding a reduced cost is obtained with regard to moulding, as against the cost when made from loose patterns on the floor. There is, however, also the aim to obtain better castings. Sometimes castings are not only put on the machine for the former results, but also are put on for the purpose of obtaining better castings. It does not always follow that if the casting is put on the machine from the floor a reduction takes place, but it is suggested that castings which can be made on the floor at certain prices might be manufactured on the machine at prices similar, and secure castings of much better finish.

This term "better" casting is from the point of view of variation from pattern or pattern

(*Concluded on page* 140.)

Metal Moulds for Cast Iron

Only a short discussion followed MR. J. MCGRANDLE'S Paper on this subject, which was printed in our issue of January 16, on account of its specialised character.

MR. E. J. ROSS, who opened the discussion, asked how Mr. McGrandle determined the thickness of the mould; was it by trial and error? It seemed to him there were three factors to be dealt with or overcome, viz., heat transmission, heat absorption, and radiation. The last was the most difficult to control, and it occurred to him whether it would not be better to have a fluted mould. The first two factors, transmission and absorption, could be calculated, but to get the three working in harmony would give considerable trouble.

MR. MCGRANDLE said that the real purpose of using metal moulds was to get better castings and make them cheaper. They did not cast all day so they did not have to take such great precautions to prevent overheating of the moulds. There were pins at the back where air could be blown on, increasing the rapidity of cooling. In his case rapidity was not a factor. They made the thickness of the casting the same as the thickness of the chill. If the moulds were made thicker they kept hotter, due to greater mass, although giving better radiation. If they were made thinner they would heat up too rapidly.

MR. R. D. LAWRIE congratulated Mr. McGrandle on his Paper and on having adopted such unorthodox methods to obtain sound castings. He stated that the average foundryman was inclined to try out various dodges in the shape of gates, risers, and denseners, and few had the courage to go to such unorthodox methods as had Mr. McGrandle. He was surprised to see that the moulds were cast open, as a covered mould would have given a much more solid casting.

He noticed that the metal contained 0.5 per cent. P, and thought that with this amount there must be a considerable amount of extrusion, firstly due to graphite separation, and secondly to phosphorus. Had there been a top on, this extrusion would have been put to better account, for if the walls of a permanent mould are unable to give, a denser casting must be the result. Regarding mould dressings for permanent moulds, he had tried many and found that ordinary machine oil poured from an oil-can gave quite satisfactory results.

The oil ignites on coming into contact with the heated mould, leaving a sooty deposit on the face. He could not understand why cracks should form vertically, and suggested that they might have originated from a small blowhole or other surface defect causing a lump on the casting which scores the mould when the casting is being withdrawn.

In his opinion surface cracking was caused by the disintegration of crystals due to repeated heating and cooling. Mr. McGrandle referred to a small projection on the bottom of the casting for the purpose of removing chill, but he (Mr. Lawrie) was surprised to learn that there was any chilling present with an iron containing so much silicon and nickel.

MR. MCGRANDLE replied to Mr. Lawrie that they coated with lampblack; they could do without a coating, but in that case the mould did not last so long. Referring to cracks, as a matter of fact there are some at the bottom of the mould radiating from the centre hole. The most troublesome were the longitudinal cracks. With repeated heating and cooling of the mould two or three things could happen. Combined carbon could decompose with deposition of graphite. Expansion of the mould face was apt to accentuate the main cracks always up and down. There was a slight oxidation on the surface after two or three heatings. By allowing a quarter of an inch for machining they got a fine surface on the moulds. He did not agree with the idea of a top on the mould as it would mean having a gate and dropping the metal which would be liable to burn-on or cause local erosion.

The CHAIRMAN (Mr. D. Sharpe) made the suggestion that hematite iron might be tried with advantage. He also suggested the use of a cheese type of mould as was used in the making of tyres. He proposed a vote of thanks to Mr. McGrandle for the Paper, which had given them something to think over and had been definitely helpful.

Light Alloys

STRENGTH AND WEIGHT REDUCTION

At a meeting of the Institution of Engineers and Shipbuilders in Scotland, held at Glasgow on January 28, MR. G. A. CLAVEY read a Paper on "The Application of Light Alloys in General Engineering Design," in the course of which he pointed out that by the term "light alloy" he referred to alloys whose composition included upwards of 85 per cent. of aluminium or magnesium, or, to put it in another way, alloys with a specific gravity within the range of 3.0 to 1.8.

Light alloys were divided by composition into two main groups, namely, aluminium alloys and magnesium (elektron) alloys. Each of these was subdivided into three groups, namely, (1) common alloys, so called, which are used in the "as-cast" condition; (2) high-strength alloys, in which heat-treatment was used to improve the mechanical properties, and (3) wrought alloys. When considering the advisability of using a light metal in place of a heavy metal, there could be no general rule, and each case required individual consideration of all the conditions of service. In every application the alloy selected, especially for highly-stressed parts, had to fulfil some special function, while at the same time it should preferably be made of the lightest suitable material. Other things being equal, a saving in weight enabled the designer to obtain greater speed, or additional weight-carrying capacity, or a saving in fuel, or some combination of these. A simple method of arriving at the amount of weight to be saved by the use of a light alloy, and on the basis that the part in question must be as strong as when made in a heavier metal, was as follows:—

When W = weight of part in heavy metal; W_1 = weight of part in light alloy; T = tensile strength of the heavy metal; T_1 = tensile strength of the light alloy; G = specific gravity of the heavy metal; G_1 = specific gravity of the light alloy: then $W_1 = WTG_1/T_1G$. This was based on the fact that weight varied directly as the specific gravity and inversely as the tensile strength. It was important, however, that the values adopted for the permissible stress were actual values; it was not advisable to rely on text-book figures. The internal-combustion engine, in its many forms, was advancing rapidly in favour, and many of the latest improvements were due to the use of high-strength light alloys in place of steel and cast iron. In this respect, the item that came first to mind was the piston. Aluminium alloys containing about 8 per cent. of copper had been used satisfactorily in motor-car engine design for a number of years. Latterly, however, with the advent of the Diesel engine, it had been found that an alloy of much higher tensile strength (not only at ordinary temperature, but at high temperature) was necessary for success, and the well-known Y and ceralumin alloys were being extensively used for this purpose.

The application of light alloys to engineering construction depended, of course, not only on their mechanical and physical properties, but to a large extent on their adaptability or workability in the foundry and machine shop. The production of castings in aluminium alloys and magnesium alloys was not particularly difficult. In machining, the cutting speed should be as high as possible, a very advantageous feature, as it had a considerable effect upon machining costs. The economy in this connection, in conjunction with the saving in weight, was such that the final cost of a light-alloy part might be less than that of a similar one in cast iron, despite the higher cost of the light alloy per unit weight. The tools used in the turning operation should be finished with the keenest possible edge, and any grinding marks should be removed by oilstone. The top surface of the tool should offer as little resistance as possible to the turnings, and should be ground to a very smooth finish. A good surface was easily attainable provided that only very light cuts were made with a very slow feed. Lubricant should also be used for finishing cuts, and a mixture of paraffin oil and lard oil, or rape oil, in equal parts, was recommended for most alloys. It was most important to remember, however, that the coefficient of expansion of light alloys was high, and it was essential that the work be cooled before finishing to accurate dimensions.

Steel Agreement with South Africa

An agreement for a period of five years was signed in London last week between the South African Iron and Steel Corporation, of Pretoria (representing the iron and steel producers of South Africa) the International Iron and Steel Cartel and the British Iron and Steel Federation, whereby the requirements of South Africa, to the extent the South African producers can supply, are secured to them. The importation of the balance controlled by the British Iron and Steel Federation and the Cartel is to be regulated in a manner to ensure the most suitable source of supply. Prices will be stabilised at an economic level so calculated as to stimulate consumption of iron and steel in the South African market, the development of which by a policy of constructive co-operation is one of the principal objects of the agreement.

It is understood that the internal demands for steel are rapidly increasing, and that, after conceding to the South African works, that portion of the home market they are able to supply, the quantity of steel imported will not be seriously reduced.

Machine Moulding

(*Concluded from page* 139.)

plate. In the case of the standard size casting, the weight is much more consistent from the machine than when cast "loose-pattern," when variation in weight takes place due to rapping of the pattern. With the machines, the prices are based on rates obtaining throughout the district, and consequently for various types of machines there are various rates. Although in some shops it may be found desirable to have operators working on time rates, it is considered, with the type of machine mentioned, best to adopt piece rates. Although these machines are worked satisfactorily by youths, yet as they become of age they find it quite possible to take a reasonable wage from these machines owing to increased output, due to experience and strength.

It will be understood that there are various types of machines on the market and each type is an effort to reduce moulding costs, even when casting is taken from one machine to another. It may be considered from the foregoing, with relation to the machines, that the type is useful and economical for turning out very suitably varied types of castings, and the author considers they are an asset to the foundry, where a various assortment of small castings are required from time to time.

The Control of Cupola Operation

By H. L. CAMPBELL and JOHN GRENNAN

(*Concluded from page* 118.)

The Coke Charge

The coke in the bed which is consumed to furnish the heat for melting the metal charges is replenished by the intermediate coke charges. In this way, the coke bed is maintained at the correct level to ensure favourable melting conditions. To decrease the formation of carbon monoxide which lowers the temperature of the gases, the coke charges are kept as small as practical. With the ordinary sizes of foundry coke, the pounds of iron melted per pound of coke are based upon the assumption that 50 per cent. of the heat produced from the combustion of the coke is used in melting and superheating the iron. The ratios which are most commonly used are from 7 to 11 lbs. of metal melted per pound of coke. The weight of one metal charge is found by multiplying the weights of one coke charge by the factor which will give the desired amount of superheat in the metal.

TABLE III.—*Weights of Materials in Cupola Charges.*

Dia. Inside Lining, In.	Area Inside Lining, Sq. In.	Volume 6 In. High, Cu. In.	Coke per Charge, Lb.	Limestone per Charge, Lb.	Weight of One Metal Charge — Ratio 7 to 1, Lb.	Ratio 8 to 1, Lb.	Ratio 9 to 1, Lb.	Ratio 10 to 1, Lb.	Ratio 11 to 1, Lb.
32	804	4,824	74	15	518	592	666	740	814
36	1,018	6,108	94	19	648	752	846	940	1,034
42	1,385	8,310	128	26	896	1,024	1,152	1,280	1,408
48	1,810	10,860	167	33	1,169	1,336	1,503	1,670	1,837
54	2,290	13,740	211	42	1,477	1,688	1,899	2,110	2,321
60	2,827	16,962	261	52	1,827	2,088	2,349	2,610	2,871
66	3,421	20,526	316	63	2,212	2,528	2,844	3,160	3,476
72	4,072	24,432	376	75	2,632	3,008	3,384	3,760	4,136
78	4,778	28,668	441	88	3,087	3,528	3,969	4,410	4,851
84	5,542	33,252	512	102	3,584	4,096	4,608	5,120	5,632
90	6,362	38,172	587	117	4,109	4,696	5,283	5,870	6,457

layers less than 6 in. in thickness are not readily obtained. Therefore, each coke charge will contain a definite weight of dry coke which can be placed in a height of 6 in. within the cupola. This amount of coke can be determined experimentally by weighing the coke which will fill a cylinder having the same diameter as the cupola and a height of 18 in., and dividing by three. The volume occupied by one pound of foundry coke varies with the method of manufacture, as well as the care taken in handling this fuel. If the relation of weight to volume for a specific coke cannot be found by trial, it may be assumed that as an average, one pound of foundry coke occupies 65 cub. in. The weights of the coke charges given in Table III for cupolas of different sizes were calculated on this basis. The coke charges are placed as level as possible over the entire area of the cupola so that the top of the coke bed will remain level during the entire melting period.

When large pieces of iron scrap or large bundles of steel scrap are included in the metal charges, it is desirable to have the coke charges of sufficient thickness so that combustion will be maintained for the length of time required for all the metal in each charge to be melted before it reaches the region containing free oxygen.

The Metal Charge

The heat from the combustion of the coke preheats, melts, and superheats the pig-iron and scrap metals in the charges. The ratio of the weight of metal melted for each pound of coke is dependent upon a number of conditions among which are: (1) the quality of the coke, (2) the relative proportion of the surfaces of the pieces of metal which are exposed to the hot gases, and (3) the amount of superheat required in the metal. The greater the fixed carbon content of the coke, the more heat will be produced from a given weight of this fuel. Scrap metals having relatively thin sections absorb heat more rapidly than heavy pieces of pig-iron or scrap. Furthermore, the metal which is poured into castings with light sections is usually heated to higher temperatures than the metal which is used in castings with heavy sections.

When steel scrap is used in the charges for the cupola, some carbon is necessarily consumed in carburising this material. Therefore, the ratio of the weights of metal to coke must be established on the basis of all the operating conditions. The values given in Table II for

In Table III the weight of one metal charge is given for different iron to coke ratios and for cupolas of different sizes.

The Flux Charge

The non-metallic, non-combustible materials which accompany the cupola charges, or are produced during melting, form a viscous slag within the cupola. If this slag be allowed to accumulate in sufficient quantity, it will interfere with good melting practice. The combustion of the fuel and the melting of the metal are retarded by the presence of a gummy slag which adheres to the surfaces of the pieces of the stock. Furthermore, slags which fuse at high temperatures obstruct some of the gas passages through the charges, and this condition will make uniform melting impossible. The viscosity of cupola slags is lowered by the addition of fluxes to the charges. Limestone ($CaCO_3$) is the most important cupola flux, although fluorspar (CaF_2) and soda ash (Na_2CO_3) are also used for this purpose.

The most satisfactory fluxing material is calcium oxide (CaO), which is produced by the decomposition of limestone within the cupola.

TABLE IV.—*Air Supply and Melting Rate.*

Dia. Inside Lining In.	Lb. Coke per Charge 6 In. High	Cu. Ft. Air to Burn One Coke Charge Total	Cubic Feet of Air per Minute — To Burn One Coke Charge in 4 Min.	To Burn One Coke Charge in 5 Min.	To Burn One Coke Charge in 6 Min.	Melting Rate: Tons per Hour — 9 Lb. of Metal Melted per Lb. of Coke — 4 Min.	5 Min.	6 Min.	8 Lb. of Metal Melted per Lb. of Coke — 4 Min.	5 Min.	6 Min.
32	74	7,548	1,887	1,509	1,258	5.0	4.0	3.3	4.4	3.6	3.0
36	94	9,588	2,397	1,917	1,598	6.3	5.1	4.3	5.6	4.5	3.8
42	128	13,056	3,264	2,611	2,176	8.6	6.9	5.8	7.7	6.1	5.1
48	167	17,034	4,259	3,407	2,839	11.3	9.0	7.5	10.0	8.0	6.7
54	211	21,522	5,381	4,304	3,587	14.2	11.4	9.5	12.7	10.1	8.4
60	261	26,622	6,656	5,324	4,437	17.6	14.1	11.7	15.6	12.5	10.4
66	316	32,232	8,058	6,446	5,372	21.3	17.1	14.2	18.9	15.2	12.6
72	376	38,352	9,588	7,670	6,392	25.4	20.3	16.9	22.6	18.0	15.0
78	441	44,982	11,246	8,996	7,497	29.8	23.8	19.9	26.5	21.2	17.5
84	512	52,224	13,056	10,445	8,704	34.6	27.6	23.0	30.7	24.6	20.5
90	587	59,874	14,969	11,975	9,979	39.6	31.7	26.4	35.2	28.2	23.5

The calcium oxide combines with silicon (SiO_2) oxide to form a calcium silicate slag.

$$CaO + SiO_2 \rightarrow CaSiO_3 \qquad (3)$$

This reaction requires 1.66 lbs. of pure limestone, or 1.71 lbs. of limestone containing 3 per cent. of impurities to unite with each pound of silicon oxide.

The silicon oxide content of the cupola charges is derived mainly from the ash of the coke, from the products of oxidation of the metal, and from the sand on the iron scrap. If it is assumed that the coke contains 10 per cent. ash, and that 250 lbs. of coke are required to melt 2,000 lbs. of metal, 25 lbs. of ash will be produced in the cupola during the melting of every ton of metal. Since the ash contains approximately 50 per cent. of its weight of silicon oxide, the combustion of 250 lbs. of coke will produce 12.5 lbs. of silicon oxide.

During the melting of the metal mixtures in the cupola, silicon is oxidised to the extent of about 10 per cent. of the total silicon in the metal charges. The silicon oxide from this source collects in the cupola slag. If it be assumed that the total metal mixture contains 2.20 per cent. silicon, the normal oxidation of 2,000 lbs. of metal will result in the formation of 9.4 lbs. of silicon oxide. When this amount is added to the weight of silicon oxide from the coke used in melting the metal, a total of 21.9 lbs. will be obtained. The weight of limestone which will be required to produce a liquid slag by combining with the silicon oxide from these two sources alone amounts to 37.4 lbs. This is equivalent to about 15 per cent. of the weight of the coke used. Other sources of slag are the cupola-patching material and the sand on the metals which are charged into the furnace. The limestone is apportioned according to the conditions of operation for every cupola; as a rule, 20 per cent. of the weight of the coke consumed in melting is a satisfactory proportion for the limestone additions. The limestone flux is distributed uniformly over each coke charge and is kept away from the lining. Since the coke can usually be placed more level in the cupola than the metal charges, the limestone can be distributed more uniformly over the coke layers.

Fluorspar is a very active fluxing agent for cupola slags, and is often supplied with limestone in the cupola charges; as little as 5 per cent. of the weight of the limestone is sufficient to increase noticeably the fluidity of the cupola slag.

Soda ash is also used to increase the fluidity and the dissolving action of cupola slags. Under favourable conditions soda ash is a valuable desulphuriser of the metal. A combination of one part of soda ash and ten parts by weight of limestone is sometimes used as a cupola flux.

The Air Supply

The operation of the cupola furnace requires a continuous supply of fuel and air. The volumes of air required to burn 1 lb. of coke under different combustion conditions have been derived and are given in Table I. Also, the method of computing the weight of one coke charge has been established, and the weights of the coke charges for cupolas of different sizes are given in Table III. From these values the volume of the air required for the combustion of one coke charge can be readily found. The amounts of air which will burn one coke charge under combustion condition F in cupolas of different sizes are given in Table IV. These values do not take into account any losses in the blast pipe or wind belt.

It is proposed that the rate of burning the coke and melting the metal in a cupola be computed on the basis of the units used in charging the solid materials. This in turn will fix the rate of supplying the air. Different rates of melting can be obtained by changing the air supply to a cupola. In Table IV the melting

rates for cupolas of different sizes are given on the basis of burning one coke charge and melting one metal charge in 4, 5 and 6 min.

One of the factors which should influence the choice of the melting rate is the cost of supplying air to the cupola. When the efficiencies of the mechanical equipment are disregarded, the horsepower for supplying air is obtained by multiplying the volume of the air in cub. ft. per min. by the pressure in ounces per sq. in. and again by the factor 0.0003. Since the pressure increases with the volume of the air delivered to a cupola, the power increases more rapidly than the melting rate. The following data apply to the operation of a 54-in. cupola:—

	Combustion rate.		
	4 min.	5 min.	6 min.
Volume of air, cub. ft. per min.	5,381	4,304	3,587
Average operating air pressure, oz. per sq. in. ..	20	13	9
Melting rate, tons per hr. ..	14.2	11.4	9.5
Horsepower required ..	32	16	10
Horsepower per ton per hr.	2.3	1.4	1.1

It has been shown that the cost of power is less for the slower melting rate; however, other conditions may offset this advantage. The requirements for molten metal from a single melting unit may make it necessary to use more rapid melting. A 72-in. cupola has been operated to melt 30 tons of iron per hr., which is equivalent to a rate of 3 min. for burning one coke charge and melting one metal charge. The practice which is generally preferred is to use a combustion rate of 5 min. for each coke charge.

Any changes in the melting rate of a cupola must be accompanied by corrections in the height of the coke bed, if favourable combustion conditions are to be maintained. When the melting rate is decreased by supplying less air, the height of the coke bed is automatically lowered as a result of the formation of carbon-monoxide gas. On the other hand, when the air supply is increased, the pressure in the wind belt, and hence the velocity of the gases in the coke bed are increased. This causes the region containing free oxygen in the cupola to be raised, and makes a higher coke bed necessary in order to avoid the oxidation of the metal charges. The only method of raising the height of the coke bed after the operation of the cupola has been started is to supply extra coke to the subsequent charges. Therefore, it is not good practice to increase the air supply without providing in advance the extra coke needed to build up the bed.

Penetration and Distribution of the Air

The actual conditions of the penetration and distribution of the air supplied to the cupola furnace are often misunderstood. Many designs of special tuyeres have been proposed for obtaining greater penetration of the air towards the centre of the cupola. Since the coke bed forms an ideal baffle to the directional penetration of the air stream, there is no possibility of forcing the air in a given direction by restricted areas or by special shapes of tuyeres. It has also been assumed that air at low pressure would travel up the lining of the cupola and would not penetrate the bed coke.

The following investigation was carried out to determine the actual distribution of the air within the coke bed of a cupola. Twenty-eight copper tubes, ¼ in. in dia. were placed in the coke bed of a 32-in. cupola, with their ends at seven equidistant positions across the bed and at levels of 14, 20, 26 and 32 in. above the top of the tuyeres. These tubes extended to the outside of the cupola, and were connected to water manometers. The entire coke bed, containing pieces of coke averaging 3 in. in size was then built up to a height of 48 in. above the top of the tuyeres. A positive-displacement blower driven by a variable-speed motor was used to supply air to the cupola. Four rectangular tuyeres with a total inside area of 95 sq. in. were provided. At a pressure of only 4 ozs. per sq. in. in the wind belt, the pressures across each level of the coke bed were nearly the same, with a tendency for slightly higher pressures in the centre of the cupola at the lower levels where the measurements were made.

Materials were then charged into the cupola on top of the coke to increase the resistance to the flow of the air. When the pressure in the wind belt was raised to 10 ozs. per sq. in., the pressures across the bed at each level were practically constant, with slightly increased pressures at the centre of the cupola. These measurements were made with the air and coke bed at room temperature. Under normal operation of the cupola, other conditions, such as the expansion of the gases by heat and the increase in volume due to the formation of carbon-monoxide gas, will probably influence the distribution of the gases to some extent. However, it could reasonably be expected that the distribution of the gases across the bed of the cupola above the tuyeres when the coke is burning is fairly uniform. The construction of the coke bed is such as to favour the distribution of the air in the cupola, except when careless charging or insufficient slagging causes the obstruction of the gas passages through the bed. On the basis of the results obtained from the investigation described above, there is little prospect of any advantage to be gained in the distribution of the air by restricting the area of the cupola above the tuyeres or by reducing the size of the tuyere openings.

American Notes and Developments

BY OUR NEW YORK CORRESPONDENT.

Alloys of Iron Research

The Engineering Foundation have announced the appointment of three representatives of the steel industry to the Alloys of Iron Research Committee. Dr. John Johnston, director of research of the United States Steel Corporation, was named by the committee to represent the American Iron and Steel Institute. The late Dr. John A. Mathews has been succeeded by Mr. Wilfred Sykes, a director of Inland Steel Company. He has been appointed member-at-large. The third new member of the committee is Mr. James T. Mackenzie, metallurgist and chief chemist of the American Cast Iron Pipe Company. He takes the place of Mr. R. E. Kennedy, technical secretary of the American Foundrymen's Association.

The Alloys of Iron Research Committee is well known for its world research, embracing all phases of steel and iron and their alloys. Co-operating with the committee, of which Prof. George B. Waterhouse—a Sheffield University graduate—of the Massachusetts Institute of Technology, is chairman, is a group of nearly 150 persons, including some of the world's foremost specialists in alloy steels, metallurgists, physicists, chemists, engineers and superintendents of alloy-steel plants.

The committee has a collection of classified abstracts; 15,300 of them. Foreign language abstracts have been translated into English. Six monographs have been issued to date and nine are in the course of preparation, with five more planned. Two volumes dealing with alloys of iron and carbon will appear soon under the auspices of the foundation, according to official announcement.

The material dealing with iron and chromium alloys is 80 per cent., drafted and ready for the thorough investigation by committee advisers and consulting editors. The foundation's elaborate monograph on iron and manganese is ready for the printer; all data have now been assembled, including the results of the basic research conducted with the aid of the foundation at the Carnegie Institute of Technology.

The literature review of the iron-vanadium monograph is almost finished, and preliminary work for the study of cast iron is progressing, the foundation officials affirm. The work of the committee, on which £25,000 has already been spent, is described as "the most extensive search of a brand of technical literature ever undertaken and the most comprehensive, if not the only, collection of such data in the world."

Iron Roads

From Minneapolis comes news of an interesting research which has for its purpose the testing of the feasibility of iron pavement. Prof. E. Davis, head of the University of Minnesota's Mines Experiment Station, designer of the apparatus to determine the value of iron paving, has been working on the problem for some time. An automobile, perched on a steel treadmill, in one of the school's laboratories, is the principal element in the tests. Hour after hour its wheels revolve, sometimes as fast as sixty-five miles an hour, stopping when the brakes are applied.

The car rests on a series of flywheels on which the types of iron paving are fastened. The speed of the flywheels and automobile wheels, braking force and side and vertical vibrations of the car are recorded on dials as the flywheels are brought to a stop. If the experiment is successful and the value of iron paving is determined, there may be a possibility of creating a market for Minnesota's low-grade iron ore. Prof. Davis claims that iron paving's skid-proof qualities are superior to any other known type.

A Metal with a Memory

Mr. Robert M. Kalb, of the Bell Telephone Laboratories, advances the opinion that iron has a "memory." "Iron acts as if it had a memory," he says, "because it governs its actions in a way that depends upon the changes it has undergone in the past." Mr. Kalb has been working out research problems in alternating-current magnetisation. Iron and other metals exhibiting similar properties are used extensively in the telephone transmission apparatus. Inasmuch as the voice currents contain a large factor that is like a complex alternating current, it is necessary to ascertain the true inwardness of what takes place in iron under the influence of alternating currents. Every condition to which iron has been subjected leaves an impression on it, and its response in succeeding instants is influenced by the residual impression. The "memory" is due, according to Mr. Kalb, to configuration of the molecules in the iron crystals.

The Industrial Research Department of the University of Pennsylvania states that foundry operations in the Philadelphia Federal Reserve district declined for the month of November, 1935. This opinion is based on the reports received from foundries operating in the area mentioned.

The total production of grey-iron castings during November were slightly larger than in the previous month, due to the unusual activity in a few plants, especially certain jobbing foundries located in Philadelphia. A comparison with previous records, which date back to 1926, shows that this is the first time that the foundries have been able to continue during November an increased rate of activity established in October.

The production of malleable-iron castings, although well below the unusual peak of October, was still more than at any time in the last nine years. The output of steel castings decreased in most of the plants, but the total output was still well above that reported a year ago.

Shipment of iron and steel castings declined during November, but the tonnage of deliveries during the month exceeded by more than 20 per cent. those of November, 1934. Unfilled orders, which also declined during November for both iron and steel castings, were larger than those of last year.

Frit-Kiln Bricks

CAUSES OF SPALLING

A meeting of the Southern Section of the Institute was held at British Industries House, Marble Arch, London, W.1, on Tuesday, November 19, 1935, Mr. B. B. Kent in the chair.

"Frit-Kiln Bricks" was the subject of a Paper presented to the Institute and printed in our issue of December 5 last. It gave rise to a lengthy discussion, which was opened by the chairman, MR. B. B. KENT, who said he gathered that an ideal arrangement was that the jointing should have an expansion equal to the shrinkage of the bricks.

MR. HUGILL agreed that that would be an ideal condition, if one could rely upon getting it.

MR. C. P. STONE, bearing in mind Mr. Hugill's reference to bricks with high alumina content as being desirable, asked if there were an ideal brick suitable for frit making and which would not spall.

Cause of Spalling

MR. HUGILL replied that the causes of spalling were fairly evident. When a brick was heated at the face and the back was relatively cool, there was a definite expansion at the face, or a tendency to expand. If the face were then chilled suddenly, that piece of the brick made a sudden movement, and if it were not sufficiently plastic to take up that movement, fracture must result. With regard to the means of overcoming the trouble, he said that, if one burned a brick to incipient vitrification, giving it a good soaking and carrying the reactions as far as possible, and then cooled it slowly, there would be crystallisation. (The reactions were never carried to completion, and it would not be of any use to carry them to completion, because in that event the bricks would be glasses.) If one could get the greater part of the brick matrix finely crystalline rather than glassy (vitreous), there was some possibility of movement being taken up in the mass without necessarily causing rupture. It was well known that a silica brick would spall, because its thermal expansions were much higher than those of a firebrick. If, however, the quartz changed to the form of triangular crystals, which were tridymite, this had a small thermal expansion at its critical points; therefore, sudden changes of temperature gave rise to much less sudden contraction or expansion, and less strain through the whole mass. In addition, these crystals were in all sorts of orientations, more or less like the pieces in a bundle of hay, or a felt, so that the material had strength in all directions and resisted or would take most of the shock produced by sudden temperature change.

MR. STONE said it was well known that some bricks had been in use for many years, the dropping of the cold batch on to them having no effect; they would not spall. But, with modern methods of melting—he had in mind rotary melting—spalling was being experienced. He asked if Mr. Hugill could suggest a solution to the difficulty, for it was widespread.

MR. HUGILL replied that the actual chilling due to the cold batch being dropped on to the brickwork in the ordinary way did not cause spalling; yet, if one chilled the hot brickwork under the batch, spalling occurred. Thus the actual mechanical movement of the lining relative to the batch itself was bringing the two into more intimate contact.

Spalling in Rotary Furnances

MR. STONE referred to the case of a melting cylinder, with a diameter of just over 9 ft., where the actual area occupied by the batch would not be more than 4 ft. The temperature of the whole would be roughly 900 deg. C. as a minimum, and yet spalling still occurred. When the batch was dropped in and one closed the lid, spalling occurred not only at the part on which the batch dropped but all over the cylinder. He would be glad to have further information as to the cause of, or prevention of, spalling relative to the rotary melting of enamel.

MR. DIXON asked if the flaking were due to some physical change in the surface of the refractory.

MR. STONE said he would not like to make a statement on recrystallisation, because it did not come within the sphere of the ordinary enamelling technologist. He would, however, like to know whether there was available a brick which would not spall.

Open- and Close-Texture Bricks

MR. HUGILL said that one could obtain a brick which would not spall readily; but would it give equally good service in other respects? Spalling was only one of the difficulties to be overcome. If a brick were sufficiently dense it was always thermally sensitive and would not easily resist the spalling tendency.

MR. STONE said that in practice he had found that the open-texture bricks dissolved.

MR. J. T. GRAY said that when the sillimanite brick was first introduced into the combustion chambers there had been a tremendous amount of spalling, although the temperature had remained approximately the same, week in and week out. The spalling had occurred at anything from $\frac{1}{8}$ to $1\frac{1}{2}$ in. The brickmakers were called in and, after careful examination, they had concluded that the grain of the brick was wrong. Therefore, they had supplied a brick of coarser grain, and that brick definitely did not spall, whereas the fine-grained brick would spall every time. Unfortunately, however, on changing from the fine-grained to the coarse-grained brick, there was a change from spalling trouble to fusing trouble. The two bricks were similar, except in texture.

Open-pored Bricks more Resistant

MR. HUGILL replied that a certain amount of the quartz changed to the secondary mineral, cristobalite, and that had critical points, which varied a little but were somewhere between 230 and 275 deg. There was always a considerable part of the quartz remaining in the brick in the unchanged condition, and that would give the critical change every time it passed through the temperature of 575 deg. C. That effect was obtained so long as there was quartz present.

MR. GRAY asked what was the experience of the effect of grain size upon spalling.

MR. HUGILL replied that coarse texture and open-pore space was always conducive to resistance to spalling. A brick of that type was definitely more resistant, assuming the chemical composition to be the same. That applied also to silica bricks to some extent; the finer texture silica bricks were slightly more liable to spall unless the quartz content had been altered. In a firebrick more porosity than one could allow for frit-kiln bricks, and more open texture, would cure the trouble owing to the freedom of movement that would result, enabling the brick to take up thermal shock and so helping to prevent spalling.

MR. H. G. FRY mentioned his own experience in connection with rotary melters in which ordinary fireclay refractories were used. The melters, he said, were cooled off during the night, and each morning they were heated to a maximum temperature just above the ordinary working temperature before the batch was put in, so that the cold batch fell right on to the hot refractory. Generally speaking, one would imagine that those conditions would induce spalling, but he had never seen any evidence of it whatsoever.

MR. STONE commented that that was the answer to his own question as to whether there was a brick available which would not spall.

Official Spalling Test

MR. HUGILL said that the official spalling test was very severe. The brick under test was put into a furnace and heated at one end—it was built into the door so that it could be removed easily—and after being heated to a predetermined temperature it was taken from the furnace and dipped into a tray through which water was flowing at a constant level of about 1 in. Thus, 1 in. of the depth of the brick was submerged in the water. Subsequently the brick was dried on the top of the furnace; when free from steam it was put into the furnace again and the process repeated. After a few reheatings and quenchings, the loss of weight of the brick was taken as a measure of the destruction which had occurred.

MR. STONE suggested that that treatment was more severe than the attack of an enamel or a glass which had penetrated beneath the surface of a brick, and should produce spalling more readily than would the attack by the enamel or glass.

MR. HUGILL replied that, granted that glass did get into a crack beneath the surface layer of the brick, its effect would depend upon how it expanded and contracted relative to the brick due to fluctuations of temperature or due to any crystallisation which might occur. If recrystallisation occurred during use in definite layers at some depth in the brick, it would definitely be harmful, because it would loosen that part of the brick and force it out, so that it would rise to the surface and be destroyed. It was a matter of flotation.

MR. STONE said everyone understood that there was a recrystallisation factor, and that recrystallisation occurred at beyond the critical temperature. It seemed to him, however, that the question he was raising, *i.e.*, that of lamination or wafer spalling, represented quite a minor tragedy in many trades, and especially in the enamel trade. It would be well to devote attention to that particular difficulty with a view to finding a way out of it.

Definition of Spalling

MR. DIXON suggested that the term "spalling" was being used in two different senses. Some were referring to thermal spalling, which was due to temperature change or gradient; and others were referring to the physical change in the surface of the refractory as the result of temperature or the action of the fluxes and enamel. He imagined that thermal spalling could not be regarded as an important item of trouble in rotary melters. It seemed that the trouble was physical spalling. It was difficult to determine what was the action between the enamel and the refractory, and the fact that enamels varied considerably rendered the problem still more difficult. He had arranged some tests in one particular case with firebricks having alumina contents of 33, 40 and 50 respectively and a sillimanite. Very little difference was noted in regard to the service given by the grades, and physical characteristics seemed as important as alumina content. These tests were made in a stationary melter.

MR. HUGILL urged that further research was needed. The type of disintegration occurring in the tests could be referred to as flaking rather than as spalling.

MR. DIXON said that he would call it shallow physical spalling.

MR. HUGILL remarked that there was a tendency to refer to shallow effects as flaking rather than as spalling. When the high-frequency induction furnaces were first built in this country, flaking, rather than ordinary spalling, had been very prevalent. The inside of the crucible was heated by induction very much more rapidly than the outside of the crucible. The crucible had a $\frac{1}{2}$-in. wall, and one could almost

place one's hand on the outside when metal was melting inside; thus, the inner circle of refractory expanded rapidly, whereas the refractory on the outside was practically stationary, and under those circumstances something had to go; large flakes came off the inner lining. A considerable amount of research had been devoted to that problem, however, and the trouble had become very much less prevalent nowadays than it was during the early trials of high-frequency induction furnaces in this country.

MR. H. CAMERON, referring to the suggestion in the Paper concerning the modification of frit-kiln work, asked whether Mr. Hugill meant modifying the application of the batch into the kiln or whether he had in mind other methods to produce crystallisation of the interior of the kiln?

MR. HUGILL said his suggestion was that in the first stages of operation of a new lining, in order to get the crystalline layer on the surface of the refractory, one should heat up the lining and glassy layer and then slowly cool it without regard to the production of frit. After that one could proceed with the production of frit; and he advocated that if possible one should maintain the temperature of the refractories at not much below 800 deg. during their useful life, instead of allowing them to cool down and then starting up again and heating the refractories at a terrific rate. By preserving the higher temperature one was able to preserve the thin crystalline layer intact for much longer than if the refractories were allowed to become cold from time to time and were then heated rapidly to working temperature.

Monolithic Linings

MR. E. CHIFFEY, enlarging upon the reference to induction furnaces, said he believed it was usual at one time to make the crucibles with rammed material. A metal former was used, of the shape of the crucible, and the material was rammed round that; by maintaining the metal lining at a certain temperature for a certain time, the clay lining was baked through an inch or a fraction of an inch, according to requirements. Then, by increasing the load on the furnace, the metal lining was actually melted, and it became the first charge of metal. Mr. Chiffey asked if any work had been done on the use of a similar type of rammed lining for vitreous enamelling furnaces.

MR. HUGILL replied that rammed linings were used, and he believed they gave satisfactory results; probably in some cases they gave results superior to those obtained with bricks. It was generally stated that a rammed lining had no joints; as a matter of fact, however, it had more joints than a brick lining, because every piece of grog had a plastic material joining it to other pieces of grog. The joints, however, were not in straight lines; probably in most brick linings the joints were too much in straight lines instead of crossing them in each ring. Frequently one saw deep corrosion lines following the line of junction between one brick and another in the rotary type of furnace.

MR. DIXON said that rotary melting furnaces and induction furnaces for metal had practically always the monolithic form of lining, probably of ganister or some other siliceous material. He did not know of any successful rammed linings of aluminous material in rotary frit-melting furnaces.

MR. HUGILL added that some of the linings in metallurgical induction furnaces were of magnesite with a high iron content, and those linings were very satisfactory, but would not be satisfactory for frit kilns from chemical composition. Iron oxide had very marked solvent properties for aluminous material.

Vote of Thanks

MR. STONE, proposing a vote of thanks to Mr. Hugill, said that his Paper had been very in-

(*Concluded in next column.*)

Institute of British Foundrymen

LANCASHIRE BRANCH ANNUAL DINNER

The twentieth annual dinner of the Lancashire Branch of the Institute of British Foundrymen was held at the Grand Hotel, Manchester, on Saturday, February 1. The Branch-President, Mr. J. Jackson, presided. The dinner was preceded by progressive whist, and followed by dancing until 11.30 p.m. There were 222 members and guests present, among them being Mr. J. E. Hurst (President of the Institute) and Mrs. Hurst; Mr. J. Jackson (the Branch-President) and Mrs. Jackson; Mr. J. M. Newton (President of the North-Western Branch of the Institution of Mechanical Engineers) and Mrs. Newton; Mr. E. C. McKinnon (President of the Manchester Section of the Institution of Electrical Engineers) and Mrs. McKinnon; Mr. J. A. Thornton (President of the Manchester Association of Engineers) and Mrs. Thornton; Mr. L. E. Benson (President of the Manchester Metallurgical Society) and Mrs. Benson; Mr. H. G. King (President of the Institute of Production Engineers) and Mrs. King; Mr. H. Turner (British Northrop Loom Company, Limited) and Mrs. Turner; Mr. P. B. Wolfe (chairman of the Manchester and District Ironfounders' Employers' Association) and Mrs. Wolfe; Mr. J. E. Cooke (hon. secretary of the Lancashire Branch of the Institute of British Foundrymen) and Mrs. Cooke; Mr. R. A. Miles (social secretary of the Lancashire Branch of the Institute of British Foundrymen) and Mrs. Miles; and Mr. T. Makemson (secretary of the Institute of British Foundrymen).

Letters of apology for unavoidable absence were received from Mr. and Mrs. Winterton; Mr. C. W. Biggs, Vice-President of the Institute; Mr. Ellis Smith, M.P., for Stoke-on-Trent, and Mr. and Mrs. V. C. Faulkner.

The customary loyal toast was proposed by the President of the Branch, and duly honoured.

"The Lancashire Branch"

The toast of "The Lancashire Branch" was proposed by MR. W. A. WALSH (director of Messrs. Howard & Bullough, Accrington), who

(*Concluded from previous column.*)

structive with regard to the technicalities, the physical and chemical properties of refractory bricks, and he expressed the hope that at some time in the future Mr. Hugill could be persuaded to give further information concerning the wear and tear and general utility of the bricks, and the manner in which the life of the bricks was affected by the conditions under which they were used. Probably a brick used in one of the old-time furnaces, in which the heat was maintained continuously from Monday until Saturday, would not fail, whereas the same brick, subjected to the sudden blast of a modern oil or gas burner, might suffer from all sorts of troubles.

MR. GRAY, seconding, said that not only had the Paper been instructive, but it had also brought to light the necessity for further research on frit-kiln linings required by the enamelling industry.

MR. HUGILL, in the course of his response, said the discussion had proved that there was definite scope for further research on the disintegration, and so forth, of refractory materials used in particular ways. Some of the differences in the behaviour of refractories in the old and the newer types of furnaces were due to the ill-treatment they received; there was a much more rapid heating in the modern rotary furnace than was possible in the old-fashioned reverberatory furnaces.

referred to the growth of the Branch from a very small beginning, and to its present day far-reaching influence throughout the foundry trade of Lancashire. It had extended its scope of operations so much that branch sections had been established at Preston and Burnley, while there was also a flourishing junior section at Manchester. Such progress was a fitting indication of evolution from the ancient craft and guild stage of industry. It was a noteworthy feature of the activities of the Lancashire Branch that it paid most especial attention to the industrial education of youths who became apprentices to the craft.

MR. J. JACKSON (the Branch-President), in responding to the toast, said that doubtless there were people who wondered why anybody entered the foundry industry. Perhaps they thought it was due to the persistence of the spirit of youthfulness, and that foundrymen liked to play about with sand and to make a fire blaze up, just as children all over the world delighted to do. Personally, he thought the reason went somewhat deeper, because founding was more allied to applied science than many other trades. From the days of Tubal Cain to the present day there had been developments and improvements in what might justly be termed the art of founding. Nowadays people were trying to mechanise foundries, which, in its way, was a good thing; nevertheless, the skilful foundryman would have to be something of an artist in the way he turned out his work. He would define art as being the faculty for producing something new, something original, and that was happening in the foundry every working day. He concluded by paying a very fitting tribute of thanks to the hon. secretary, Mr. J. E. Cooke, for the excellent work he had done on behalf of the Branch, and also to Mr. R. A. Miles, the social secretary, for the really splendid way he had arranged the proceedings for the evening.

"Our Guests"

MR. J. HOGG (Burnley) proposed the toast of "Our Guests," to which Mr. J. E. Hurst responded, and conveyed the felicitations of all the other Branches of the Institute to those assembled.

MR. J. A. THORNTON (President of the Manchester Association of Engineers) also responded, referring to the fact that a request had been made that speeches should be kept down to the minimum length. It was another instance of great minds thinking alike, for it had been decided in the case of the Association of which he had the honour to be President that only a few words of welcome should be expressed on the occasion of their annual dinner.

At intervals during the evening "Wilt" and "Walt," entertainers (Messrs. W. Pilkington and W. Schofield, of Accrington), gave selections from their repertoire, accompanied by Mr. J. Thompson on the piano.

All-Electric Hospital for Glasgow

Glasgow Corporation will shortly be in the market for extensive electric plant for their new infectious diseases hospital which is to be erected at Cowglen, Glasgow, and which will be the largest all-electric hospital in Great Britain. The hospital will have the most up-to-date installation of electrical appliances, and the Corporation have appointed Primrose & Primrose, Limited, Great Western Road, Glasgow, as consulting engineers for this work. The installation will consist of electrode boilers, heating, domestic hot-water systems, electric lighting and kitchen and laundry plant, and it is the intention of the Corporation to dispense with both coal and gas in the equipment of the hospital. Electrode boilers will supply steam for the laundry and kitchen plant and apparatus, together with all the requirements in connection with central heating and domestic hot water through several blocks of buildings. The estimated load will be in the neighbourhood of 4,000 kw.

The immediate question and important task of supplying acid resisting enamels are problems that are constantly being tackled by our experts.

We have, at last, gathered the fruits of our labours, and should you desire to entrust us with your special requirements we can assure you that they will receive our very best attention.

Our Associated Company JAMES DAVIES, Ceramic Transfers, Berry Bank, Stafford Street, LONGTON, Stoke-on-Trent, will be pleased to supply suitable vitreous transfers.

N. SINCLAIR & CO. LTD.

CLYDE COLOUR & CHEMICAL WORKS, NILE STREET, BURSLEM, STOKE-ON-TRENT.

Leaves From a Foundryman's Notebook

VII.—CIRCULAR WORK

By RECORDER

The above title for the following notes is one that was in the past quite often applied to work that was struck up in loam. Those were the days when isolated castings were required of any given size, before the modern tendency of standardisation became in vogue. Figs. 1 and 2 illustrate two jobs which come under that denomination; only on very rare occasions were two or more alike required. To-day these castings are standardised, and patterns are used in conjunction with a moulding machine for their economical production. It still sometimes occurs, however, that either a flywheel as Fig. 1 or a belt pulley with a plate centre as Fig. 2 is required out of the standard range of sizes—to give a different speed to the machine on which it is used. How to produce this odd size casting at an economical figure now becomes the problem, and it has been found that whenever practicable it pays to make a mould from the nearest available size wheel and make the alterations in the sand.

There are times, however, when this is impossible, and the old method of striking up a

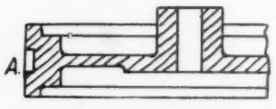


FIG. 1.

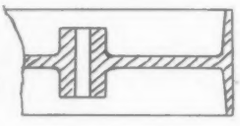


FIG. 2

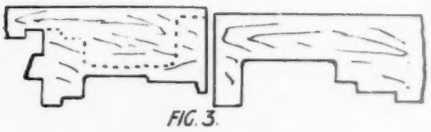


FIG. 3.

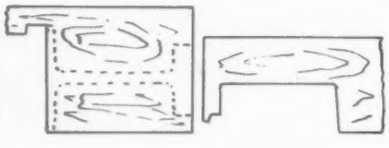


FIG. 4.

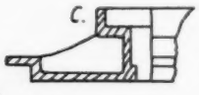


FIG. 5.

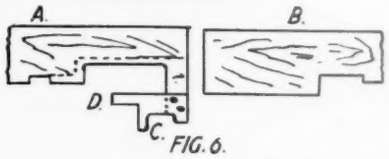


FIG. 6.

mould has to be resorted to. In that case the sweeping boards required to produce these examples are as shown in Figs. 3 and 4. It will be noticed that although the castings are somewhat similar, yet the sweeping boards are different, that for Fig. 1 being made to produce a two-part mould, and that for Fig. 2 to make a three-part mould. The reason for the difference is that if the mould of Fig. 2 was made as for Fig. 1, it would be a very difficult job—in this particular example—to blacken the ring part of the mould, which is comparatively deep for its width.

Another feature of interest is shown in Fig. 1, this being the series of teeth cast around its periphery for barring. These are made in a number of segmental cores and placed in the print impression in the mould. It will be noticed on reference to the print portion on the sweep in Fig. 3 that it has a considerable taper on the outside. This taper is also imparted to the core box, and its significance is to ensure the barring cores are inserted the correct way up, thus ensuring the teeth being in the required sense in relation to the direction of rotation. The method of using the various sweeps is not described, this being apparent from the notes given in the second article of the series.

A further example of circular work is the cylinder cover shown in part section in Fig. 5. This example is one which for standard work would require a pattern for moulding in a three-part box, but in the present case and when the dimensions get within 4 or 5 ft. dia. it is found more convenient to build in loam. Fig. 6 shows the necessary sweeping boards, A being for the mould and B the cope. One new feature in this example is the method adopted with reference to flange C, Figs. 5 and 6. A brief *résumé* of the moulding operations will make this clear. A bottom plate of suitable dimensions having been procured, building is commenced in the usual way and carried up to D on sweep in Fig. 6. This portion of the sweep is used to strike the joint, which is required here to blacken the bottom portion of the mould. Having completed part C and struck off joint D, this part of the sweep—for C and D—which is made detachable, is now removed.

The portion of mould already swept is—after having been allowed to stiffen—dusted with parting sand and filled in with new moulding sand. A suitable building ring is now placed in position over a thin layer of loam which has been spread over the face of the flange and along joint D. The six ribs are next introduced into the building in a similar manner to those in article two and the bottom mould is finished off. In the meanwhile the cope is made on a suitable plate by board B and the whole is stoved. On withdrawal—after drying—the bottom is separated along joint D, and the new sand removed and the whole blackened. Assembly is now commenced, the bottom plate is levelled up and the other piece returned to its place. The centre core is next inserted and the cope put in place and the finished mould made ready to receive the metal.

Simultaneous Estimation of Ash and Sulphur

For the simultaneous determination of ash and sulphur in coals, M. M. KEFELI and E. R. BERLINER in "Koks i Chim.," recommend the ignition of a 0.25-gr. sample in a porcelain boat and absorption of the products in 3 per cent. hydrogen peroxide with subsequent titration with 0.02-N sodium carbonate (using methyl orange as an indicator) to determine the sulphur. Finally, the ash is weighed.

German Pig-Iron Trade in 1935

A YEAR OF IMPROVEMENT

The output of pig-iron in Germany in 1935 showed a marked improvement over the previous year, the increase in tonnage being 44 per cent. from 8,700,000 metric tons to 12,500,000 tons. This advance is, however, to a large extent apparent only, as from March 1 the output of the Saar furnaces was included in the German figures. Compared with 1932, the 1935 figure shows an increase of 219 per cent. The most striking comparison is obtained by the growth in the average daily output figures, from the low level of 10,745 tons in 1932, to 14,430 tons in 1933, 23,950 tons in 1934, and 34,355 tons last year.

The distribution of the output among the various districts has not changed much, except that the inclusion of the Saar has diminished the percentage share of Rhenish-Westphalia. In 1934, the output was made up of 7,290,000 tons from Rhenish-Westphalia, 310,000 tons from the Sieg-Lahn-Dill area, and 1,140,000 tons from other districts, while in 1935 the distribution was as follows:—Rhenish-Westphalia, 9,090,000 tons; Sieg-Lahn-Dill, 360,000 tons, and other districts (including the Saar from March 1), 3,090,000 tons. On the other hand, there has been some change in the production of the different qualities of iron. The increase in the outputs of hematite and foundry irons has been comparatively small, the bulk of the gross increase being due to a larger production of basic and steel-making irons. The much greater figure for basic iron is due to the inclusion of the Saar furnaces.

Furnaces Operating

The number of furnaces built increased from 148 at the end of 1934 to 176 on December 31 last, owing to the inclusion of the Saar, and those in blast at the end of each year, from 73 to 108. The number of furnaces damped down has diminished in recent years, from 44 at the end of 1932, 31 at the end of 1933, and 16 at the end of 1934 to 7 on December 31 last, while the number of furnaces charged and ready for lighting has been halved, from 27 at the end of both 1932 and 1933 to 14 at the end of 1935. Furnaces completely idle numbered 31 at the end of 1933 and 25 on December 31 last; over the same period the number of furnaces undergoing repairs has increased from 13 to 22.

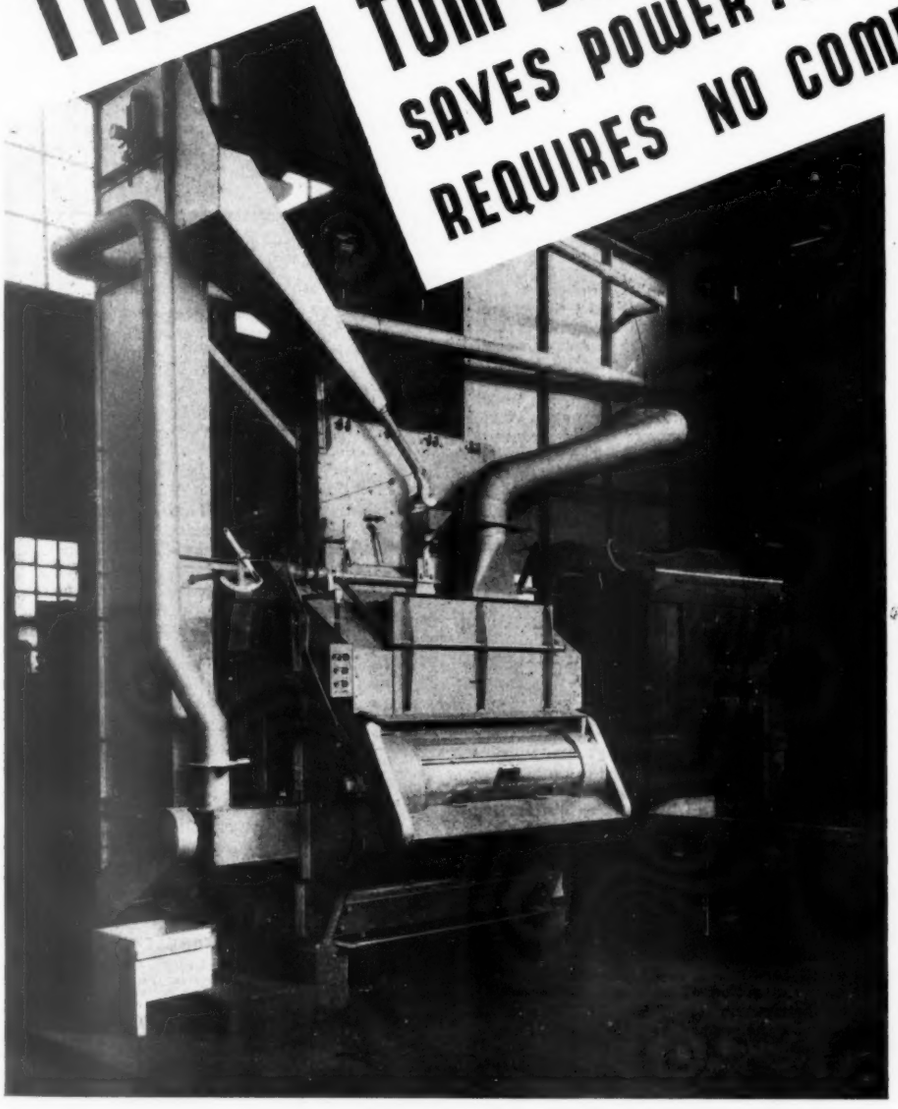
The bulk of the pig-iron made is consumed in the producers' own works and only a comparatively small quantity is placed on the market for sale to foundries and steelworks and for export business. The inland trade has made substantial progress.

Prices in the home market remained unchanged throughout the year, and the export bonus of 14 Rmk. per ton of pig-iron in the finished product has also been maintained. The latter is only paid to consumers who cover at least 95 per cent. of their pig-iron requirements from the Pig-Iron Syndicate. The export trade has shown a satisfactory increase, principal competition being met from Russia. The future outlook of the pig-iron trade is regarded as good in all branches.—"Deutsche Bergwerks Zeitung."

Increasing Austin Foundry Output

The new cupola recently installed in the Austin foundry at Longbridge, Birmingham, is another example of the scientific accuracy with which all stages of modern motor-car production are now controlled. The cupola is of the balanced-blast type which gives hotter and better quality iron, less loss by oxidisation, and more complete fuel combustion with resulting economy of coke. To ensure accuracy of control this cupola is equipped with B.T.-H. automatic air-weighing instruments, which deliver the exact amount of air necessary to give complete combustion of the fuel, and the feed of raw material and fuel is also automatically maintained by a new type of charging plant. This cupola, which was built by the Constructional Engineering Company, of Birmingham, to designs developed by the British Cast Iron Research Association, is over 6 ft. in dia. by 55 ft. in height, and has a maximum delivery of 12 tons of special grey iron hourly. It feeds two mechanised casting tracks, which, besides much other work, are making 350 cylinder block and cylinder head castings daily for Austin engines; additionally, it serves a large floor moulding section. A second cupola of the same size and type is at present in process of being installed.

THE WHEELABRATOR TUM-BLAST SAVES POWER ..... REQUIRES NO COMPRESSOR



One Wheelabrator, with a 15-H.P. motor, is more effective than three blast nozzles with 90 lbs. pressure, using 100 to 150 H.P. The Tum-Blast illustrated will clean 3 tons of hard iron or malleable castings in one hour—and no compressor is used. The saving in power will pay for the machine in less than 12 months.

Tilghman's, being the biggest manufacturers of Sand Blast plant of all types, including now, the new abrasive cleaning machines, are in a position to offer and demonstrate the processes to suit your individual requirements.

Let Tilghman's advise you!

Sole manufacturers and suppliers for British Empire (excluding Canada):

TILGHMAN'S

PATENT SAND BLAST CO., LTD.

BROADHEATH, Nr. MANCHESTER.

Telephone: Altrincham 540. Telegrams: Tilghman's Altrincham.

London Office: 17, Grosvenor Gardens, S.W.1.

2115 M

This Week's News in Brief

Trade Talk

THE MORGAN CRUCIBLE COMPANY, LIMITED, has acquired a controlling interest in the Ship Carbon Company (of Great Britain), Limited.

THE ANGLO-DANISH TRADE AGREEMENT of 1933 expires on June 20, 1936, and negotiations for its renewal are due to begin in London this month.

THE THREE SHIP'S BELLS for the "Queen Mary" will be cast in the bell foundry of John Taylor & Company, Loughborough. The largest will weigh 350 lbs.

THE NEW STEEL FOUNDRY of Qualcast, Limited, of Derby, is now in production. Increased output is announced, and the directors anticipate a satisfactory year's trading.

A LARGE ORDER for solid-drawn black-steel boiler and superheater smoke tubes has been placed with Stewarts and Lloyds, Limited, Glasgow, by the Buenos Ayres Great Southern Railway.

AT THE VULCAN FOUNDRY, LIMITED, Newton-le-Willows, two thousand men are employed on contracts which include 69 locomotives for the L.M.S., locomotives for China and boilers for India.

THE ANDERSON-GRICE COMPANY, LIMITED, of Taymouth Engineering Works, Carnoustie, Scotland, have opened an office in London at Windsor House, 46, Victoria Street, S.W.1 (telephone Victoria 3989).

THE INSTITUTION OF AUTOMOBILE ENGINEERS announce that their Research Department at 5, Bolton Road, Chiswick, London, W.4, has been closed down, and that all communications should now be addressed to the Institution at Great West Road, Brentford, Middx. The telephone number is Ealing 4741/2.

UNDER THE AUSPICES of the Falkirk Branch of the Electrical Association for Women, a large party visited the Carron Company's works on February 5. The party witnessed the cast at the blast furnaces, and then visited the power station, enamelling department, the foundry and the electrical cooking and heating departments.

THE CONDITION of the iron and steel industries in the West of Scotland is revealed in the number of extensions now being carried out. Glenfield & Kennedy, Limited, are building a new brassfoundry. G. & T. Weir, Limited, Cathcart, are altering property at their works, and the Fairfield Shipbuilding & Engineering Company, Limited, will extend their brass-finishing shop. The Steel Company of Scotland are planning to enlarge their melting shop.

BENJAMIN ELECTRIC, LIMITED, invited the technical Press to inspect their Brantwood Works at Tariff Road, Tottenham, on February 4. After touring the works and examining the various manufactures, the party was conveyed back to London and entertained to luncheon at Frascati's Restaurant. Mr. Guy Campbell (managing director) presided and Mr. A. E. Iliffe (director) outlined the company's activities, which he summed up as being a concentrated effort to sell light. Later Sir Harry Brittain, also a director of the company, proposed the toast of "The Press."

LEEDS ASSESSMENT COMMITTEE has decided to reduce the net rateable value of the engineering works of Messrs. Kitson & Company, Limited, Airedale Foundry, Hunslet, from £1,117 to £950 a year. An appeal for reduction of the assessment was made by Sir Leonard J. Coates, the receiver for the company. It was stated that at the present time certain of the shops were unoccupied, and there was no immediate prospect of work being found for them. The company's business was the construction of heavy locomotives. It had been 90 per cent. export trade. Competition at present was so very keen that it was almost impossible to get an order.

IN AN OFFICIAL STATEMENT issued by Messrs. Dorman, Long & Company, Limited, it is announced that within the next two months it is intended to bring into operation three additional blast furnaces at the Cleveland Works, thus raising the number of active furnaces at the company's works to 16. In addition, two newly-reconstructed blast furnaces, one at Redcar and one at Acklam, will be blown in to replace two now due for repairs. It is added that while the output from these furnaces will be mainly to meet additional requirements of steel-making iron, it will also lead to an easement of the shortage of foundry iron for the market. Including auxiliary services, this will mean additional employment for about 200 men.

THE BRITISH FOUNDRY SCHOOL, which offers a training of one year's duration, of an advanced character in foundry science and practice, made an excellent beginning in October last and thirteen students are taking the course for the first session, now in its second term. In addition to the lectures and laboratory work, supervised by a permanent lecturer-in-charge, Mr. J. Bamford, special courses are given by members of the staff of the Birmingham Central Technical College, in which the School is housed. Furthermore, over fifty lectures were given during the first term by specialists of repute in various aspects of foundry work, and similar numbers are arranged for the second and third terms. Each week a foundry visit is made, and during the session it is hoped to arrange for a three-day visit to another foundry centre, during the last term.

Contracts Open

Swansea, February 17.—Cast-iron pipes and specials, for the Town Council. The Water Engineer, Guildhall, Swansea.

Doncaster, February 24.—Cast-iron water pipes and special castings, for the Town Council. The Water Engineer, 2, Priory Place, Doncaster.

Johannesburg, February 20.—Two petrol-driven tower wagons, for the City Council. The Department of Overseas Trade. (Reference T.Y. 5,672.)

Wolverhampton, February 20.—Wires and cables; cast-iron street lamp standards; transformers; switchgear, etc., for the Town Council. Mr. T. A. G. Margary, 83, Darlington Street, Wolverhampton.

Birkenhead, February 18.—Cast-iron brake blocks; wrought-iron and steel bars; aluminium sheets; phosphor-bronze castings; trolley wheels, cable, etc., for the Town Council. The General Manager, Corporation Transport Department, Birkenhead.

Brandon, February 17.—Providing and laying 700 yds. of 4-in., 6-in., 9-in. and 12-in. sanitary pipe sewers, 800 yds. of 18-in. iron pipe sewers in tunnel and on piers, with manholes, etc., for the Brandon and Byshottles Urban District Council. Messrs. Taylor & Wallin, 1, Saville Place, Newcastle-upon-Tyne, 1. (Fee £5, returnable.)

Company Reports

International Nickel Company of Canada, Limited.—Quarterly dividend of 25 cents.

British Oxygen Company, Limited.—With a view to commemorating the fiftieth anniversary of the company, the directors recommend capitalisation of part of the reserves by the free distribution of two fully paid bonus ordinary shares of £1 each for every £7 ordinary stock held.

Hammond Lane Foundry Company, Limited.—Credit balance for 1935, £23,269; available after deducting income tax and depreciation, £15,065; brought in, £2,204; final dividend of 10 per cent., making 15 per cent. for the year; to general reserve, £4,620; to workmen's compensation reserve, £1,000; carried forward, £3,173. The directors recommend the capitalisation of part of the general reserve by the distribution of 12,500 £1 fully-paid ordinary shares in the proportion of one new share for every six held.

Applications for Trade Marks

The following list of applications to register trade marks has been taken from the "Trade Marks Journal":—

"ELGA."—Cooking stoves and ranges, ovens and hotplates for cooking. Burslem's Patents, Limited, Bank Buildings, 20, Kingsway, London, W.C.2.

"KORBESTOS."—Compounded impregnated asbestos core plates for use in foundries. Bingley, Son & Follit, Limited, Millbank Works, Chase Road, London, N.W.10.

Applications to the Cutlers' Company, Sheffield.

"WALLOY."—Machinery and parts; cutlery and edge tools. Walker Steelworks, Limited, 97, Mary Street, Sheffield.

Personal

MR. W. E. COOPER, A.I.C., M.I.A.E., has resigned his post with R. A. Lister & Company, Limited, of Dursley.

SIR ARCHIBALD MITCHELSON has been elected chairman of Messrs. J. Samuel White & Company, Limited, shipbuilders, of Cowes.

MR. G. A. WHITE and Mr. H. R. Ayton have been appointed assistant managing directors of Messrs. Richard Thomas & Company, Limited, the tinplate and steel manufacturers.

MR. THOMAS MARSLAND, of Droylsden, manager of David Owen's Iron Foundry, Monton, Lancs, was detained in the Eccles and Patricroft Hospital, as the result of injuries received in a 'bus accident last Thursday.

RUSTON & HORNSBY, LIMITED, have appointed two new directors, Mr. H. B. Riggall, who has occupied the position of commercial manager for many years, and Mr. T. W. Fairhurst, who will take over duty as sales director from March 1.

MR. G. R. WEBSTER, A.M.I.Mar.E., A.I.E.E., who has been intimately connected with the Deptford and Charlton foundries of J. Stone & Company, Limited, has recently been appointed to the post of works manager of the Britannia Iron & Steel Company, Limited, of Bedford.

Obituary

MR. W. EMMETT, manager of the Woolfold Engineering Company's works, Bury, Lancashire, died recently, aged 58.

MR. ROBERT REDHEAD, who for 30 years was traffic manager at John Spencer & Sons' steelworks, Newburn (now dismantled), has died, aged 71.

MR. JAMES RENTON JACK, who was one of the founders, and latterly works manager, of the Forth & Clyde Steel Foundry, Limited, Kirkintilloch, died recently.

MR. ALEXANDER MACRAE, who until September last year was the secretary of the North British Steel Foundry Company, Limited, died at Bathgate on February 3.

MR. JOHN BAIRD, a well-known figure in foundry and sporting circles in Falkirk and district, has died at his home in Gibson Gray Street, Bainsford, aged 75 years. He was for many years works' foreman at Abbot's Foundry, succeeding his father, who was employed there in a similar capacity 37 years ago. Mr. Baird retired three years ago.

Forthcoming Events

FEBRUARY 28.

The Manchester Association of Engineers:—"The Manufacture and Application of Modern Cast Irons." Paper by J. W. Gardom, at the Engineers' Club, Albert Square, Manchester, at 7.15 p.m.

Institute of British Foundrymen

FEBRUARY 14.

Wales and Monmouth Branch:—"The Heat-Treatment of Steel Castings." Paper by Prof. W. R. D. Jones, D.Sc., at the Y.M.C.A., Llanelly, at 6.30 p.m.

FEBRUARY 15.

Lancashire Branch:—"Alloy Cast Irons." Paper by P. A. Russell at the Engineers' Club, Albert Square, Manchester, at 4 p.m.

Wales and Monmouth Branch:—Short Paper Competition at the University College, Newport Road, Cardiff, at 6.30 p.m.

FEBRUARY 21.

Sheffield and District Branch:—"Sand and Shot Blasting." Paper by J. H. D. Bradshaw at the Grand Hotel, Sheffield, at 7.30 p.m.

FEBRUARY 22.

East Midlands Branch:—"Non-Ferrous Castings." Paper by A. Logan at Loughborough College, Loughborough, at 6 p.m.

Newcastle-upon-Tyne and District Branch:—"Foundry Products through the Microscope." Paper by E. B. Ellis at Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6.15 p.m.

The Institute of Vitreous Enamellers

FEBRUARY 20.

Birmingham:—"Heat-Resisting Steels and their Application to Pettits and Pettit Design." Paper by J. G. Holmes and A. Linley at the Chamber of Commerce, New Street, Birmingham, at 7.30 p.m.

SAND MIXING AND HANDLING

●

Engineering Skill and Foundry Technique have, during the past year or two, displayed a remarkable desire to marry for the benefit of the Foundry Industry.

The result is observable in the number of Foundry organisations which are bringing their production units up to date.

Much has already been done by way of modern layout and the installation of new plant, but it must be acknowledged that a vast amount of work still awaits execution.

This announcement will, we hope, remind you that we are well able and desirous of placing proposals for Modern Foundry Equipment before you.

●

FOUNDRY ENGINEERS LIMITED

HALIFAX, YORKS

Telephone: Halifax 61459. Telegrams: "FEL," Halifax.

Raw Material Markets

Rather more new business has been in circulation during the past week, but the chief concern of producers at the present time is the fulfilment of their contracts. Production of pig-iron shows signs of falling short of consumers' needs, although deliveries have been maintained in accordance with commitments. Hematite quotations have been revised, the increased costs of production having made this move inevitable.

Pig-Iron

MIDDLESBROUGH.—Trade in foundry iron in this area has been brought almost to a standstill. The steel companies are in need of large supplies of pig-iron for the furnaces and production of foundry numbers is small. Makers have no supplies for sale apart from withdrawals from stock. There are a few stacks almost ready to be put into operation, but whether they will be used for the production of common iron is still uncertain. Supplies of coke continue to be scarce. No change has been made in prices, but these are only nominal at the present time, No. 3 Cleveland G.M.B. being quoted at 70s. per ton delivered Middlesbrough or Falkirk, 72s. on the North-East Coast and 73s. on Clydeside.

Hematite quotations have risen in accordance with expectations, for it was obvious that the producers would have to pass the burden of increased costs on to consumers. Material continues to be in short supply and makers are having to refuse new business. New prices are now in force, No. 1 East Coast quality being quoted at 77s. per ton in the Middlesbrough zone.

LANCASHIRE.—There continues to be a scarcity of new inquiries, and business consists of small tonnages. Textile-machinery manufacturers have improved requirements and deliveries to these works are on a good scale, as is also the case in most other directions in the Lancashire area. For delivery to users in the Lancashire price zone, offers of Derbyshire, Staffordshire and Lancashire brands of No. 3 foundry iron are all on the basis of 78s. per ton, with Northamptonshire at 76s. 6d. The price of West Coast hematite has advanced to 85s. per ton, delivered equal to Manchester, and East Coast quality is quoted at 84s. 6d. to 85s. per ton.

MIDLANDS.—No alterations were made in pig-iron prices at a meeting of the Central Pig-iron Producers' Association held recently. However, it is generally expected that prices will rule higher in the near future. A premium of 5s. is being asked for on forward transactions. Ironfounders continue to be well employed, and the engineering and jobbing trades are expected to have increased requirements. The minimum Association quotations for ordinary foundry iron delivered Birmingham and Black Country stations are 72s. 6d. for Northants No. 3 and 75s. for Derbyshire, Lincolnshire and North Staffs No. 3. Large consumers receive a sliding-scale rebate. The demand for special irons has been maintained on a satisfactory level. Values are inclined to become firmer. Medium-phosphorus iron is on offer at between 77s. 6d. and 87s. 6d., low-phosphorus from 90s. to 97s. 6d., and refined pig-iron from £6 7s. 6d. to £7 15s. per ton delivered this area. Very strong conditions still prevail in the hematite section of the market. Prices have been advanced, and are £4 7s. 6d. for East Coast No. 3, £4 8s. 6d. for West Coast mixed numbers, and £4 7s. for Welsh mixed numbers, delivered Midland stations, plus 1s. 6d. extra into works.

SCOTLAND.—Active conditions continue to prevail in the Scottish pig-iron market. On account of the firm quotations ruling in the scrap market more pig-iron is being taken up. However, supplies of pig-iron are not too plentiful, and it is proving increasingly difficult to satisfy consumers' needs. Values, as yet, are unchanged, the official minimum of 74s. f.o.t. furnaces for No. 3 foundry still being quoted, with 2s. 6d. per ton extra for No. 1. The light-castings founders have heavy demands, but they are not being fully met. No. 3 Cleveland prices are unaltered, and are 70s. f.o.t. Falkirk and 73s. f.o.t. Glasgow, with other English foundry irons quoted at 1s. 3d. per ton below the foregoing figures. Local steelworks continue to be well engaged, and large deliveries of both hematite and basic are being made to them. Values are higher at 76s. 6d. for mixed numbers of Scottish hematite, 77s. for mixed numbers of East and West Coast hematite, and 70s. (less 5s. rebate) for both British and Indian basic, all delivered f.o.t. steelworks here.

Coke

There has been rather less inquiry for supplies of coke during the past week, but prices have not become easier as had been anticipated. For delivery in Birmingham and district best Durham coke is quoted from 41s. 6d. to 43s., and Welsh from 38s. to 50s. per ton.

Steel

Active conditions rule in the steel market and production in practically all branches of the industry is on a heavy scale, says the official report of the London Iron and Steel Exchange. In one or two departments new business has been rather quiet, but this is a seasonal movement and is not surprising in view of the buying which has continued for several months. Some relief has been afforded to the stringent conditions which have existed in the semi-finished steel market for some time by the importation of increased quantities of Continental material; but consumers' requirements are still considerable. Practically all the British works are operating at capacity, and in many cases have fallen into arrears with deliveries. Satisfactory conditions rule in the finished-steel department. There has been a large volume of buying of late, and many of the producers are showing reluctance to commit themselves as far forward as consumers would be prepared to contract. Export business in almost all departments has been quiet.

Scrap

Supplies of good heavy melting steel are still short on the Cleveland market. Machinery cast-iron scrap is scarce at 65s., while clean light cast-iron is on offer at 51s. 6d. All descriptions of scrap material have a good demand on the Midland market. Business is chiefly confined to small parcels for prompt delivery. Heavy steel in furnace sizes is at 55s. and mixed heavy iron and steel is at 52s. 6d. Short, heavy steel scrap, as used in the foundries, is now quoted at 62s. 6d. to 65s. per ton, delivered works. Prices are still firm and well maintained on the Scottish market. Heavy mild-steel melting scrap, in furnace sizes, is at 57s. 6d. per ton, with heavy basic or heavy iron and steel scrap mixed, 52s. 6d. Heavy machinery cast-iron scrap is in short supply, and the price is firm at 67s. 6d. to 70s. Ordinary heavy cast-iron scrap is 62s. 6d. to 63s. 6d. per ton, delivered f.o.t. consumers' works.

Metals

Copper.—Rather more activity has been noticeable in this market during the past week. Two or three thousand tons of refined copper have been taken up by Russia and there has been increased inquiry from the Continent. Most countries, including Britain, are employed in the process of increasing and mechanising their defence forces and this is bound to mean a bigger consumption of the red metal in some form. Industrial demand is on a good scale, the building industry being particularly active in this respect.

Daily market prices :—

Cash.—Thursday, £34 12s. 6d. to £34 13s. 9d.; Friday, £34 16s. 3d. to £34 17s. 6d.; Monday, £34 15s. to £34 16s. 3d.; Tuesday, £35 1s. 3d. to £35 2s. 6d.; Wednesday, £35 1s. 3d. to £35 2s. 6d.

Three Months.—Thursday, £35 to £35 2s. 6d.; Friday, £35 3s. 9d. to £35 5s.; Monday, £35 2s. 6d. to £35 3s. 9d.; Tuesday, £35 8s. 9d. to £35 11s. 3d.; Wednesday, £35 8s. 9d. to £35 10s.

Tin.—There is only a moderate demand for this metal in this country, though values are higher. Quiet conditions are also reported on the Continent and in the United States, but in the latter market there have been one or two short spells when the demand became quite active. The general opinion is that the worst of the stringency in spot tin seems to have passed, but it will be surprising if the scarcity of spot metal disappears in the present month.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £202 15s. to £202 17s. 6d.; Friday, £202 15s. to £203; Monday, £203 10s. to £203 15s.; Tuesday, £206 10s. to £207; Wednesday, £208 15s. to £209.

Three Months.—Thursday, £196 15s. to £197; Friday, £197 to £197 5s.; Monday, £197 15s. to £198; Tuesday, £199 10s. to £200 10s.; Wednesday, £201 5s. to £202.

Spelter.—Dull and featureless conditions have obtained in this market recently. Industrial demand is on a low scale. The galvanising industry remains a poor consumer and, while negotiations for a revival of the Zinc Cartel are believed to be progressing slowly, little confidence seems to have been gained from this move.

Official quotations were as follow :—

Ordinary.—Thursday, £14 8s. 9d.; Friday, £14 11s. 3d.; Monday, £14 11s. 3d.; Tuesday, £14 12s. 6d.; Wednesday, £14 12s. 6d.

Lead.—The weekly report issued by Messrs. Brandeis, Goldschmidt & Company, Limited, states that the price of lead at the present level may be considered as reasonable. Reports from the building trade show that the position remains without material change, but with the approach of better weather some revival may be expected. The cable and battery makers are still experiencing good business. Quotations in the United States are steady and buying has been on a fairly good scale.

Day-to day quotations :—

Soft Foreign (Prompt).—Thursday, £15 10s.; Friday, £15 11s. 3d.; Monday, £15 12s. 6d.; Tuesday, £15 13s. 9d.; Wednesday, £15 12s. 6d.

West of Scotland Iron and Steel Institute

The improved conditions apparent in the iron and steel industry were commented upon at the annual dinner of the West of Scotland Iron and Steel Institute, held in the Central Hotel, Glasgow. The dinner was followed by a dance, and the attendance at the functions was a record, not only for the Institute, but for the Central Hotel. The guests numbered 460. Dr. Andrew M'Cance, President of the Institute, presided, and in the course of the evening congratulations were accorded to him on his engagement to Miss J. H. G. Burford, who, together with Dr. M'Cance, received the guests. Mr. E. H. Lewis, Past-President of the Institute, proposed the toast of "The Guests," and referred to the presence, among others, of Sir William Larke, who had distinguished himself by his efforts towards getting the steelmakers to organise properly; Dr. Robert Robertson, chairman of the governors of the Royal Technical College, Glasgow, to which the Institute was very much indebted for a supply of adequately equipped young men to take up responsible positions in the iron and steel industry; Prof. Percy A. Hillhouse, President of the Institution of Engineers and Shipbuilders in Scotland; and Sir Robert Bruce, whom they congratulated on his new appointment as a Scottish director of the L.M.S. Railway Company.

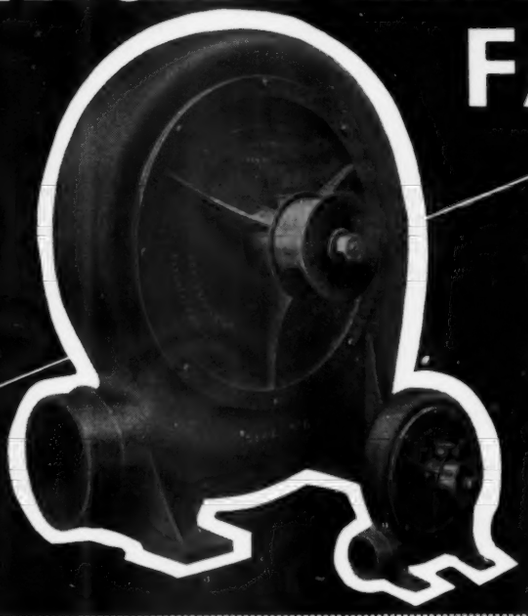
In responding, Sir Robert Bruce said that last year had been for the iron and steel industry a wonderful year, and it appeared as if 1936 would prove even better. That condition, he said, was, of course, due to the orders which had come in, but it was also in large measure a result of the unexpected settlement of the mining dispute. It might be that the owners and consumers had looked at that settlement with wintry smiles, but, added Sir Robert, think of the circumstances! The men in the mining industry had made a gesture, which, he thought, ought to be reciprocated. That gesture had permitted the reign of King Edward to commence without industrial strife. Perhaps they were not at the end of the mining problem, but they had reason to be grateful to both men and owners for having given the country a respite from industrial troubles. He was cheered by the surprising movement in shipbuilding, which promised peace in that industry also. If peace could be achieved in the coal industry and in shipbuilding they could look forward to a year of well-deserved prosperity.

DURING THE MONTH OF JANUARY 544 tons of pig-iron, 4,781 tons of steel semis and 482 tons of manufactured steel, a total of 5,807 tons, were imported into the Tees. The corresponding totals for December and November were 5,086 tons and 3,851 tons respectively.

TRADE SIROCCO MARK

HIGH PRESSURE FANS★

A Specification that cannot be improved upon



Manufactured in a wide range of sizes & designs

★ FORGE FANS
CUPOLA FANS
STEEL PLATE FANS

covering all requirements for high pressure air supply

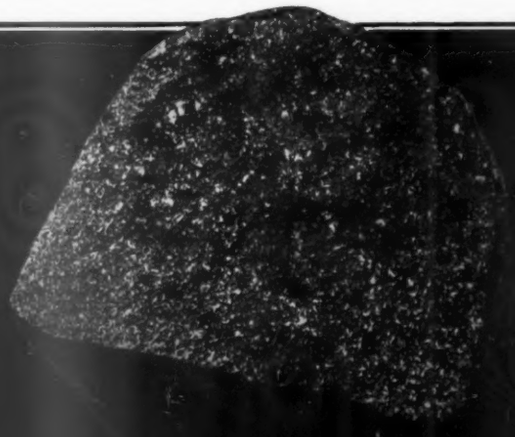
Write for Publication Ref SF 26

DAVIDSON & CO. LTD

SIROCCO ENGINEERING WORKS · BELFAST · NORTHERN IRELAND

LONDON · MANCHESTER · GLASGOW · BIRMINGHAM · NEWCASTLE · CARDIFF · BRISTOL · DUBLIN

DORMAN LONG



Manufacturers of FOUNDRY, BASIC and HEMATITE qualities. Delivery from stock. Booklet giving analyses, etc., will be sent on request.

DORMAN LONG & CO. LTD.,
MIDDLESBROUGH

AGENTS IN SCOTLAND:
MESSRS. J. & A. McMORLAND,
40 ST. ENOCH SQUARE, GLASGOW

PIG IRON

RAW MATERIALS—PRICE LIST

(Wednesday, February 12, 1936)

COPPER

	£ s. d.
Standard cash	35 1 3
Three months	35 8 9
Electrolytic	39 5 0
Tough	37 15 0
Best selected	38 5 0
Sheets	66 0 0
India	40 0 0
Wire bars	39 10 0
Ingot bars	39 10 0
H.C. wire rods	43 5 0
Off. av. cash, Jan.	34 14 10⅞
Do., 3 mths., Jan.	35 2 10¾
Do., Sttlmnt., Jan.	34 15 1½
Do., Electro, Jan.	39 0 3½
Do., B.S., Jan.	38 10 3½
Do., wire bars, Jan.	39 4 10½
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	6½d.

BRASS

Solid drawn tubes	9¾d.
Brazed tubes	11½d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7¾d.
Wire	7¾d.
Rolled metal	7¼d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£ s. d.
Standard cash	203 15 0
Three months	201 5 0
English	209 5 0
Bars	210 5 0
Straits	211 5 0
Australian	209 5 0
Eastern	207 5 0
Banca	209 15 0
Off. av. cash, Jan.	207 18 9
Do., 3 mths., Jan.	201 9 0¾
Do., Sttlmt., Jan.	209 19 0

SPELTER

	£ s. d.
Ordinary	14 12 6
Remelted	13 5 0
Hard	12 0 0
Electro 99.9	16 15 0
English	15 12 6
India	13 0 0
Zinc dust	19 10 0
Zinc ashes	4 5 0
Off. aver., Jan.	14 12 0¾
Aver. spot, Jan.	14 9 9

LEAD

	£ s. d.
Soft foreign ppt.	15 12 6
Empire (nom.)	16 8 9
English	17 10 0
Off. average, Jan.	15 8 10⅞
Average spot, Jan.	15 7 11¼

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	22 17 6
Do., V.M. ex-whse.	24 0 0
Rods	27 5 0

ANTIMONY

	£ s. d.
English	72 0 0 to 73 0 0
Chinese, ex-whse.	63 0 0
Crude, c.i.f.	31 0 0

QUICKSILVER

	£ s. d.
Quicksilver	12 2 6 to 12 8 6

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	£8 17 6
45/50%	£12 15 0
75%	£17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£18 0. 0 to £20 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	£33 0 0
4/6% car.	£21 15 0
6/8% car.	£21 0 0
8/10% car.	£21 0 0
Ferro-chrome—	
Max. 2% car.	£33 10 0
Max. 1% car.	£36 5 0
Max. 0.70% car.	£37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to 11 5 0
76/80% packed	£11 15 0 to 12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£ s. d.	£ s. d.
Heavy steel		3 5 0
Mixed iron and steel	3 0 0	to 3 2 6
Heavy cast iron	2 17 6	to 3 0 0
Good machinery	3 2 6	to 3 5 0
Cleveland—		
Heavy steel	2 17 6	to 3 0 0
Steel turnings		2 0 0
Heavy cast iron		3 2 6
Heavy machinery		3 5 0
Midlands—		
Light cast-iron scrap	2 10 0	to 2 12 6
Heavy wrought iron	3 7 6	to 3 10 0
Steel turnings		2 2 6
Scotland—		
Heavy steel		2 17 6
Ordinary cast iron	3 2 6	to 3 3 6
Engineers' turnings		2 2 6
Cast-iron borings	1 17 6	to 2 0 0
Wrot-iron piling		3 8 6
Heavy machinery	3 7 6	to 3 10 0

London—Merchants' buying prices, delivered yard.

	£ s. d.
Copper (clean)	28 10 0
Brass	19 0 0
Lead (less usual draft)	14 0 0
Tea lead	10 0 0
Zinc	8 10 0
New aluminium cuttings	74 0 0
Braziery copper	26 0 0
Gunmetal	27 0 0
Hollow pewter	150 0 0
Shaped black pewter	115 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	72/6
,, No. 3	70/-
,, at Falkirk	70/-
,, at Glasgow	73/-
,, No. 4	69/-
Forge No. 4	69/-
Hematite No. 1	77/-
Hematite M/Nos.	76/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	77/-
,, d/d Birm.	83/6
Malleable iron d/d Birm.	—
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	71/-
,, No. 3 fdry.	75/-
Northants forge	68/6
,, fdry. No. 3	72/6
,, fdry. No. 1	75/6
Derbyshire forge	71/-
,, fdry. No. 3	75/-
,, fdry. No. 1	78/-
Scotland—	
Foundry, No. 1, f.o.t.	76/6
,, No. 3, f.o.t.	74/-
Hem. M/Nos. d/d	76/6
Sheffield (d/d district)—	
Derby forge	68/6
,, fdry. No. 3	72/6
Lincs forge	68/6
,, fdry. No. 3	72/6
W.C. hematite	90/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	78/-
Staffs fdry. No. 3	78/-
Northants fdry. No. 3	76/6
Cleveland fdry. No. 3	78/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	83/6
Clyde, No. 3	83/6
Monkland, No. 3	83/6
Summerlee, No. 3	83/6
Eglinton, No. 3	83/6
Gartsherrie, No. 3	83/6
Shotts, No. 3	83/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 12 6	to 9 15 0
Nut and bolt iron	7 17 6	to 8 7 6
Hoops	10 10 0	and up.
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	and up.
Bolts and nuts, ¾ in. × 4 in.	15 5 0	and up.
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	9 5 0	to 9 7 6
Chequer plts.	10 7 6	
Angles	8 7 6	
Tees	9 7 6	
Joists	8 15 0	
Rounds and squares, 3 in. to 5½ in.	9 7 6	
Rounds under 3 in. to ⅜ in. (Untested)	8 12 0	
Flats—8 in. wide and over	8 12 6	
,, under 8 in. and over 5 in.	8 17 6	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 5 0	to 12 10 0
Hoops (Staffs)	9 7 0	
Black sheets, 24g. (4-t. lots)	11 10 0	
Galv. cor. shts. (,,)	13 10 0	
Galv. flat shts. (,,)	14 0 0	
Galv. fencing wire, 8g. plain	15 10 0	
Billets, soft	5 10 0	and up.
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 10 0	to 5 15 0
Tin bars	5 10 0	to 5 15 0

PHOSPHOR BRONZE

	Per lb. basis
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11½d.
Tubes	14d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	21.31
No. 2 foundry, Valley	19.50
No. 2 foundry, Birm.	15.50
Basic, Valley	19.00
Malleable, Valley	19.50
Grey forge, Valley	19.00
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	36.37½
Billets	29.00
Sheet bars	30.00
Wire rods	40.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.85
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.40
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	23/6 to 33/6
,, furnace	20/6 to 22/6
Durham foundry	21/6 to 23/-
,, furnace	19/6 to 21/-
Scotland, foundry	30/-
,, furnace	25/- to 23/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/9 to 19/-
,,	28×20 ,,	37/6 to 38/-
,,	20×10 ,,	27/- to 28/-
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	16/-
,,	28×20 ,,	34/-
,,	20×10 ,,	23/3
,,	18¾×14 ,,	16/3

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
Feb. 6 ..	34	12	6	dec.	1/3
„ 7 ..	34	16	3	inc.	3/9
„ 10 ..	34	15	0	dec.	1/3
„ 11 ..	35	1	3	inc.	6/3
„ 12 ..	35	1	3	No	change

Electrolytic Copper

	£	s.	d.		
Feb. 6 ..	38	15	0	dec.	2/6
„ 7 ..	38	15	0	No	change
„ 10 ..	39	0	0	inc.	5/-
„ 11 ..	39	5	0	„	5/-
„ 12 ..	39	5	0	No	change

Standard Tin (cash)

	£	s.	d.		
Feb. 6 ..	202	15	0	dec.	15/-
„ 7 ..	202	15	0	No	change
„ 10 ..	203	10	0	inc.	15/-
„ 11 ..	203	10	0	„	60/-
„ 12 ..	203	15	0	„	45/-

Tin (English ingots)

	£	s.	d.		
Feb. 6 ..	202	15	0	dec.	20/-
„ 7 ..	202	15	0	No	change
„ 10 ..	203	15	0	inc.	20/-
„ 11 ..	207	0	0	„	65/-
„ 12 ..	209	5	0	„	45/-

Spelter (ordinary)

	£	s.	d.		
Feb. 6 ..	14	8	9	No	change
„ 7 ..	14	11	3	inc.	2/6
„ 10 ..	14	11	3	No	change
„ 11 ..	14	12	6	inc.	1/3
„ 12 ..	14	12	6	No	change

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
Feb. 6 ..	16	12	6	No	change
„ 7 ..	16	13	9	inc.	1/3
„ 10 ..	16	13	9	No	change
„ 11 ..	16	15	0	inc.	1/3
„ 12 ..	16	15	0	No	change

Zinc Sheets (English)

	£	s.	d.		
Feb. 6 ..	22	15	0	No	change
„ 7 ..	22	15	0	„	„
„ 10 ..	22	15	0	„	„
„ 11 ..	22	17	6	inc.	2/6
„ 12 ..	22	17	6	No	change

Lead (English)

	£	s.	d.		
Feb. 6 ..	17	10	0	No	change
„ 7 ..	17	10	0	„	„
„ 10 ..	17	15	0	inc.	5/-
„ 11 ..	17	15	0	No	change
„ 12 ..	17	10	0	dec.	5/-

AVERAGE MONTHLY PRICES OF STEEL RAILS

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1920	18 15 0	19 5 0	20 7 6	22 0 0	23 0 0	23 0 0	24 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	22 18 11½
1921	23 5 0	20 4 0	18 0 0	17 0 0	15 0 0	15 0 0	14 0 0	14 0 0	14 0 0	11 12 6	10 10 0	10 0 0	15 4 3
1922	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 0 0	8 15 0	8 15 0	8 15 0	8 15 0	9 4 2
1923	9 2 0	10 5 0	10 10 0	10 10 0	10 10 0	10 10 0	9 15 0	9 0 0	8 15 0	8 15 0	8 19 0	9 5 0	9 9 10
1924	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 2 6	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 2 3½
1925	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 10 7½	8 10 0	8 10 0	8 10 0	8 4 0	8 0 0	8 0 0	8 11 7½
1926	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 10 0	8 3 11½
1927	8 10 0	8 10 0	8 10 0	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 3 0	8 5 0	8 5 0	8 4 10
1928	8 5 0	8 5 0	8 5 0	8 5 9	8 6 3	8 6 3	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 7 9½
1929	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1930	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1931	8 9 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 8
1932	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6
1933	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6
1934	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6
1935	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6

AVERAGE MONTHLY PRICES OF EAST COAST HEMATITE AT MIDDLESBROUGH

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1919	122 6	122 6	122 6	122 6	179 2	190 0	197 6	200 0	200 0	200 0	200 0	200 0	171 4
1920	220 0	220 0	240 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	251 8
1921	240 0	220 0	180 0	180 0	180 0	160 0	160 0	160 0	137 0	127 6	117 6	104 6	162 2
1922	97 6	91 7½	100 0	98 6	97 1½	94 7	93 6	90 9	89 7	91 10½	93 0	93 2	94 5½
1923	94 6	104 9	122 0	126 10½	122 0	115 3	107 0	98 8½	98 10½	99 1½	100 6½	102 3	107 10½
1924	102 4½	101 3	99 7½	99 0	98 9½	97 4½	95 3½	93 1½	90 7½	88 0	88 4½	88 6	95 2½
1925	87 5	85 9	84 7½	82 6	80 10½	79 3	77 1½	75 7½	75 0	74 3½	74 9	76 0	79 5½
1926	77 3	77 9	77 3½	76 3	77 4½	78 0	79 8½	81 9	83 4½	87 7½	92 6	90 5½	81 7½
1927	90	90 0	86 3½	83 1½	80 6	78 0	76 6	75 4½	75 0	72 9	71 9	71 1½	79 2½
1928	69 7½	69 7½	69 9	70 0	70 0	69 3	68 7½	69 2	70 0	70 0	70 3	71 0	69 9½
1929	71 6	72 0	73 6	74 0	74 0	74 1½	74 9	75 6	76 1½	76 8½	78 1½	79 0	74 11½
1930	78 2½	78 0	76 9	75 0	74 0	72 7½	71 0	71 0	71 0	71 0	70 10½	70 4½	73 3½
1931	70 0	69 0	68 0	66 8½	65 1½	63 4½	62 9	61 1½	65 0	65 0	65 0	65 0	65 6
1932	64 10	64 3	63 6	63 6	63 6	62 7½	62 0	60 6	60 0	59 3	59 0	59 0	61 10
1933	59 0	59 0	59 0	59 0	59 0	59 0	59 0	59 0	59 3	60 7½	62 6	62 6	59 8½
1934*	62 6	65 0	67 6	67 6	67 6	67 6	67 6	67 6	68 0	68 6	68 6	68 6	67 2
1935*	69 0	69 0	69 0	69 0	69 0	69 0	70 1½	71 0	71 0	71 0	71 0	71 0	70 1

* Since March, 1934, delivered works; previously f.o.t. furnaces.

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

B.Sc., age 25, practical experience of ferrous, metallurgy and coal distillation, 3 years' exceptional commercial experience as assistant to managing director of a commercial syndicate, including office organisation, law of contract, sales, etc., desires change. —Box 574, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY General Manager, commercial and works, seeks similar post or Technical Director. Qualified engineer, mechanical, civil and electrical. Lay-out, design, purchase, installation and operation of fully mechanised foundries.—Box 592, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

STEELFOUNDRY Foreman seeks progressive position. 37 years' practical experience in modern foundry methods; light and medium castings.—Box 560, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN.—Wanted, a thoroughly practical man to take charge of hand-moulding section of foundry in Manchester district (30 hands). Must be used to cored work and complicated castings. State age, experience, and wages required, and copies of references.—Box 588, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

STEELFOUNDRY Foreman required for a foundry in the Home Counties. Energetic, forceful, good disciplinarian. State age, wages, and experience.—Box 578, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WORKING Foundry Foreman required to take sole charge of jobbing foundry in Midlands. Green, dry sand and loam. General engineering castings up to 7 tons. Knowledge of blue-prints and cupola practice essential. State experience and wages required to Box 586, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

YOUNG MAN wanted to act as Foundry Superintendent. Must be fully experienced metallurgist and have good knowledge of the production of light castings and repetition work. Please state age, full particulars of past experience, and salary required, to Box 590, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOREMAN Brassmoulder requires position. Wide experience general and repetition, including machine moulding and aluminium practice. (272)

SITUATIONS VACANT AND WANTED.—*Contd.*

FOUNDRY Foreman requires position with progressive firm. Varied experience, including several years as foreman with manufacturers' woodworking machinery and similar plant. (273)

MACHINERY

FOR SALE, Jackman No. 4 Cupola; rated capacity 6/7 tons; good condition; £75.—Apply E. HIND, LIMITED, Imperial Works, South Bank/Tees.

FOR SALE AT LOW PRICES TO AVOID REMOVAL.

TILGHMAN Sand-blast Room Plant, complete with sand-blast apparatus, Sturtevant exhaust fan, air trunking, and dust-collecting box. Size of room 18 ft. by 9 ft. by 8 ft.

Tilghman ditto, but with room 12 ft. by 12 ft. by 8 ft. high.

Air Compressors could be supplied to each.

At present lying at works Wolverhampton.

Sclerascope for hardness-testing of metals.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E., CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham. 'Phone: Broadwell 1359.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

FOR SALE.—Three "Ajax" No. 9 Turnover Moulding Machines and one "Ajax" Stripping-Plate Moulding Machine with vibrator, complete with all accessories. Can be seen under working conditions. Price £50 each. —THOMAS BROADBENT & SONS, LIMITED, Huddersfield.

Tilghman Sandblast Barrél Plants; barrel sizes—60 in. x 40 in.; 36 in. x 20 in.; 20 in. x 30 in.

Tilghman Sandblast Cabinet Plants; 4 ft. 6 in. and 3 ft. 6 in. square (one for high pressure 70 lbs. per sq. in.); also small Cabinet 30 in. dia.

All complete with Air Compressors, etc.

Pneulec Royer Sand Thrower, size No. 1.

Six Osborne Pneumatic Jolt Press Moulding Machines, size 75J.

Three Mumford Yoke Headpress Pneumatic Moulding Machines.

Two Herbert Whizzer Sand Disintegrators.

Two Brealey Type ditto.

Heavy Double-ended Grinding Machines by Rowlands, Luke & Spencer, etc.

Hand Moulding Machines by Adaptable Darling & Sellars, Pridmore, Samuelson, etc.

500 Electric Motors, Dynamos, Rotary Converters, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E. CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham. 'Phone: Broadwell 1359.

THOS. W. WARD LTD.

Unused "Rateau" BLOWER (Fraser & Chalmers); 18" sq. outlet; designed for 12,000 cub. ft. free air per min.

Several motor-driven FORCED-DRAFT FANS; 22-h.p. motors, 100 v.; impeller 2' 3" x 1' 9"; 35" round inlet.

Three LANCS. BOILERS; 30' x 8'; 140 lbs. w.p.

Babcock W.T. BOILER; 5,540 sq. ft. heating surface; 160 lbs. w.p.

Write for "Albion" Catalogue.

Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

MISCELLANEOUS

SHOT supplies wanted for shop-blasting iron castings.—Write EDWARD MATTHEWS, LTD., Bilston Staffs.

FOUNDRY Material Purchases. Advertiser with many years' experience in buying and contracting acts as consultant on general foundry equipment, plant and sundry materials. Write without obligation for further particulars to Box 582, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATTERNS IN WOOD AND METAL for all branches of Engineering. Moulding methods carefully considered.—FURMSTON & LAWLOR, Letchworth.

'Phone: 287 SLOUGH

SAND PLANT

Herbert Whizzer, large size. £48.
Brealey Disintegrator, NEW. £26.
Pneumatic Riddles, Jackman type. £9 each.

SANDBLAST PLANT

BARREL PLANT by Tilghman, *as new*, 60" × 40", Price £240.

NEW 8' × 8' ROOM PLANT, complete. Price £230.

CAST IRON ROOM PLANT, 12' × 9', complete with 400 cu. ft. motor-driven compressor for A.C. current, in new condition. Cheap.

Several small complete barrel plants in stock.

Genuine Evans 10-ton Crane Ladle. Price £35.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

SELECT YOUR MACHINE FROM THE LARGEST STOCK OF HIGH-CLASS SECONDHAND MOULDING MACHINES IN THE WORLD

Practical Advice Free

THE COLEMAN FOUNDRY EQUIPMENT Co. LTD
156, STRAND, LONDON, W.C.2.

RYLAND'S DIRECTORY

(2,200 pages 8½" × 5½").

The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades.

A new edition ready shortly.

Price 42/- cloth bound, 52/- Morocco.

Order *YOUR* copy *NOW.*

INDUSTRIAL NEWSPAPERS, Ltd.
49, Wellington St., Strand, London, W.C.2.

Telephone: Temple Bar 3951 (5 lines).